

The 11th Edition

# **EUROALIMENT**

International Symposium  
2023

## **BOOK OF ABSTRACTS**

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Organized by  
Dunărea de Jos University  
Faculty of Food Science and Engineering  
Galați, Romania

**Book of Abstracts**

**EURO-ALIMENT 2023**

**THE 11<sup>TH</sup> INTERNATIONAL SYMPOSIUM**

**Insights of Future Foods -  
From concepts and challenges to  
technological innovations**

**19-20<sup>th</sup> October, Galați, Romania**



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## **FOREWORD**

Nowadays, food industry is facing important multi-faceted challenges due mainly to globalization, significant increase of the world population by 2050, accelerated economic growth, urbanization, new agricultural and food industry practices etc. Food industry is responsible for providing food security to all people, whereas assuring safety and nutritionally optimized foods is of major importance. Important goals should be assumed for the Agenda 2030, such as providing good health and well-being, responsible consumption and production, climate action, local economy and income generation, among others. For food industry, the need for development of sustainable food systems is of utmost importance. One major challenge concerns the necessary resources to accomplish these goals and guarantee food security.

In addition, even if food chains become sustainable, are the industry and consumers able to maintain them if the current production methods and eating habits remain unchanged? In these complex set of issues, the International Euro-Aliment Symposium 2023 provides an excellent platform to coordinate the shape of the future sustainable food system, thus proving emerging technological solutions for a changing world.

At its 11th Edition, The International Euro-Aliment Symposium 2023, organized every two years by the Faculty of Food Science and Engineering from the Dunărea de Jos University of Galați will address important topics, in order to get insights on the future foods, to establish concepts and challenges, thus supporting innovation in food industry and aquaculture. Integration of food science and technology with related fields such as biotechnology, nutrition, bioeconomy, environmental protection, etc. will play an increasingly important role in providing efficient and sustainable food systems, enabling food security, safety, quality, and responsibility assets to be delivered to the consumers, alleviating their uncertainties and un-trust in a turbulent ongoing world. By supporting the food science community and promoting new trends and drivers of food science, food technology, biotechnology, and all other food-related fields, Euro-Aliment 2023 Organizing Committee welcomes all the participants, hoping that the key topics presented and discussed will support appropriate solutions for the current and future food systems.

*The Organizing Committee of Euro-Aliment 2023 Symposium*

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## PLENARY SESSION

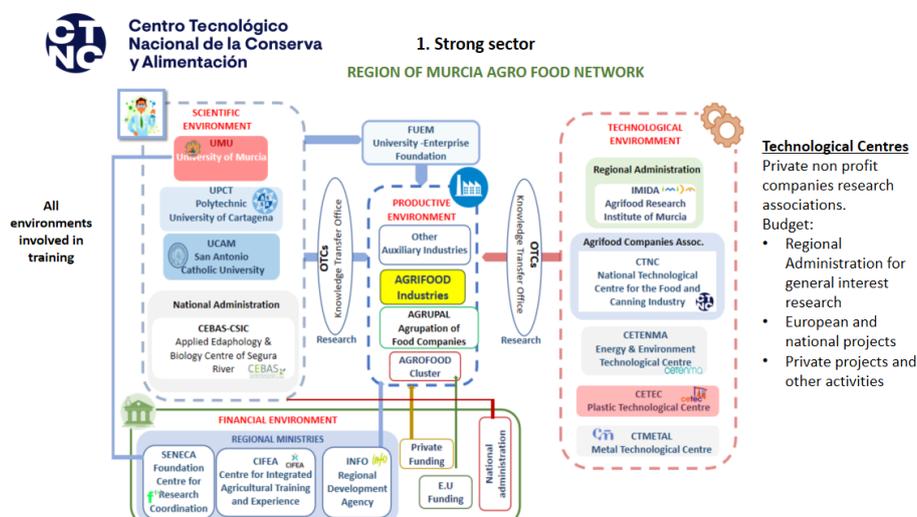
## IMPLEMENTATION OF A CIRCULAR ECONOMY IN THE AGRI-FOOD SECTOR OF THE REGION OF MURCIA, SPAIN. KEYS FOR A SUCCESS

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The transition to a circular economy is an obligation imposed by consumers, society and “common sense”. The most important part for implementing the circular economy in a company is when the end stage of whatever product it is produced is changed from “dispose” to “recover” or from “waste” to “secondary raw stream”. The main point is to be sure that the product doesn’t end up in a landfill or at the bottom of the sea. And although it can be easy to imagine how to do it, it is not easy at all to keep it profitable and to assure environmental sustainability. Companies by themselves are not prepared to make this radical change in their productions. They need technological and economic support, circular economy specialized personnel, etc. Technological Centers, Universities, Research Centers and VET Training Centers play an essential role in the transition towards a circular strategy. The administrations must generate a legislative framework that favors this transition and that helps companies financially to face the resources and expenses generated by the new personnel and equipment that must be implemented in the companies. Region of Murcia, Spain, has managed the transition in a successful way due to the previous experience in water reuse, strong agrifood sector (including financial, technological and scientific organisms), previous valorisation projects, support (policies and financial) of regional administration to the productive sector, etc.



As an example of implementation the CERVERA AGROMATTER Network will be presented. Its aims are to establish in Spain a network of Technological Centres of scientific and technical excellence in the field of the Circular Economy applied to the development of bio-based materials for technical applications, to gain recognition as R&D centres of reference both nationally and internationally, to bring about growth in R&D projects and technology transfer to the productive sector.

**Keywords:** Agrifood, circular economy, Development of new materials, Compounds of interest.

**Acknowledgment:** This research was funded by INFO Murcia and AGROMATTER project – Establishment of a Cervera Network for the development of highly sustainable technical materials derived from by-products or waste from the agricultural industry and from conservation operations of natural spaces. (Reference: CER-20211013) from Science and Innovation Ministry-CDTI- Spain.

**MICROENCAPSULATION OF *ENTEROCOCCUS DURANS* F21:  
EFFECT OF SODIUM CASEINATE, pH AND DRYING  
TECHNIQUE**

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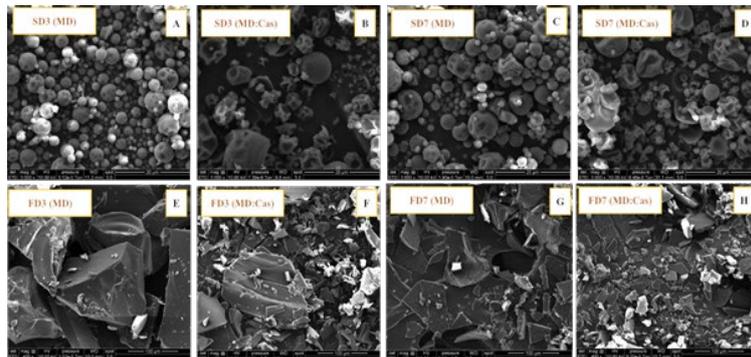
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*Enterococcus durans* F21 is a bacteriocinogenic lactic acid bacterium (LAB) with high potential for use as a biopreservative agent in foods and microencapsulation may be a good strategy for extending its viability and improving the shelf life of food products. Spray-drying (SD) and freeze-drying (FD) are the two common methods used for microencapsulation. Thus, their effect on the viability and stability of microencapsulated *E. durans* F21 cells was evaluated in this work. Moreover, this research aimed to evaluate the effect of using sodium caseinate (Cas) as a bacterial cell protectant during microencapsulation. *E. durans* F21 cells were encapsulated at two different pHs values (3 and 7). The obtained powders were analyzed for their physicochemical properties, viability after drying process, sublethal injury analysis, antimicrobial activity and stability during storage. The results showed that encapsulation yield, moisture content and particle diameter of SD powders were significantly lower than those of FD powders. The viability of microencapsulated cells was significantly influenced by the encapsulating formulation, the pH and the drying technique. Microencapsulation at pH 7 revealed higher cell viability compared to that at pH 3. Addition of Cas at pH 3 significantly enhanced the viability of cells during drying. FD microcapsules obtained at pH 3 had more injured cells than SD ones. However, SD powders obtained at pH 7 displayed higher injured cells. The spent culture supernatant of all microcapsules showed interesting antimicrobial activity against pathogen *Listeria monocytogenes*. Microcapsules obtained at pH 7 with FD method using Cas were the most stable during 8 weeks of storage. In conclusion, these findings suggest that microencapsulation of *E. durans* F21 by FD method using Cas at pH 7 could be a promising strategy for the production of high viable cells with high stability and potential use as natural preservative in foods.

**Keywords:** *E. durans* F21, Microencapsulation, Sodium caseinate, Freeze-drying, Spray-drying

**Acknowledgment:** This work was supported by a grant from PHC-TOUBKAL (Partenariat Hubert Curien Toubkal/21/114-Campus France 45854PD).



**Figure.** Microscopic observations of microencapsulated *E. durans* F21 powders obtained by SD and FD methods

## **USE OF MASS SPECTROMETRY FOR BIOMARKER DISCOVERY AND PROTEIN CHARACTERIZATION**

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Proteomics is an emerging field that focuses on the study of proteins. The workhorse of proteomic research is largely mass spectrometry (MS), which can be used to provide unbiased assessment of the protein components of a biological sample. MS can also be used to study other “omics” such as glycomics, lipidomics, metabolomics, interactomics and others. Here we describe MS and its applications for biomarker discovery and protein characterization. For biomarker discovery, we show examples of application of MS on identification of a biomarker signature for early detection and for prediction of the onset of breast cancer (BC) using human breast milk and serum as a biological matrix. Examples of protein characterization that will be presented include identification of stable and transient protein-protein interactions, MS-based structural biology and protein post-translational modifications such as disulfide bridges, N-glycan analysis, 4-hydroxynonenal (HNE) modifications and experimentally-borne alkylations. We will then focus on a particular protein, Jumping Translocation Breakpoint protein, using a variety of approaches including molecular biology, cell biology, biochemistry, MS and bioinformatics. Examples of food proteomics and metabolomics, as well as undergraduate-based projects will also be presented.

## PICKERING EMULSIONS STABILIZED BY SURFACE-MODIFIED SILICA NANOPARTICLES

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This research focused on investigating the surface modification of silica nanoparticles (nano-SiO<sub>2</sub>) with cationic surfactant cetyltrimethylammonium bromide (CTAB) in different experimental conditions to prepare Pickering emulsions (PEs) stabilized by modified nano-SiO<sub>2</sub> (MSNs). A first stage of this work, we focused on the surface properties of nano-SiO<sub>2</sub>, in function of different conditions, temperatures, pH, and levels of CTAB as coating agent, followed by their physicochemical characterization. A second part focused on the relationship between MSNs surface properties and their efficiency to stabilize PEs, considering zeta potential and emulsion physical stability as main responses, respectively. Thermogravimetric analysis (TGA), Fourier transform-infrared (FT-IR) spectroscopy, and contact angle (CA) were used to evaluate the hydroxyl groups, functional groups, and wettability of unmodified and modified nano-SiO<sub>2</sub>, respectively. Our results demonstrated that the modification temperature and system pH had the maximum and minimum influence on nano-SiO<sub>2</sub> zeta potential, respectively. The results of FT-IR, TGA, and CA confirmed the nano-silica surface modification with CTAB. The study of PEs stabilized by MSNs with different zeta potential values revealed that using MSN with a zeta potential = -26 mV was the optimized conditions for the best physical stability, obtained with the following treatment: pH = 5.5, the CTAB/SiO<sub>2</sub> ratio = 2:8, and T = 50 °C. The scanning electron microscopy images of PE droplets revealed the adsorption of the modified nano-SiO<sub>2</sub> in the oil/water interface. The optimal surface modification conditions of SiO<sub>2</sub> nanoparticles reported in this work might expand their use as PE stabilizer in the food and pharmaceutical industries and related fields.

**Keywords:** Silica nanoparticle, Modification, Pickering emulsions, Optimization.

## **TOMATO POMACE: WASTE AS THE NEW COSMETIC RAW**

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There is an increasing inclination towards developing ecologically sound procedures across various industries, and these tendencies are significantly molded by consumer preferences. The pursuit of eco-friendly solutions occupies a significant domain in various sectors, such as the fruit and vegetable processing field. Substantial quantities of byproducts from food processing contribute to the squandering of valuable resources and exacerbate the ecological load. These items serve as potential resources for forthcoming bioeconomy value chains and merchandise. An example of such a highly valuable byproduct is the oil extracted from tomato pomace. The worldwide production of fresh tomatoes reached a staggering 189 million tonnes in the year 2021 and continues to grow. Across the globe, over 39 million tonnes of tomatoes are cultivated specifically for the processing sector. The principal residual product following tomato processing is tomato pomace, comprised of skins, seeds, and a small portion of pulp. These remnants usually constitute around 2–3%, and sometimes as much as 5%, of the processed raw materials, yielding up to 2 million tonnes of tomato pomace annually. The primary objective of the research was to validate the efficacy of tomato pomace oil as a pivotal component in cosmetic formulations with regard to its skincare and protective attributes. Furthermore, given the intricate interplay between the skin's health, barrier functions, and microbiota, it is imperative to ascertain the impact of the cosmetic product on this microorganism community. Additionally, the fatty acid composition was evaluated utilizing GC-MS analysis. Ultimately, tomato pomace oil could be introduced to the market as a cosmetic raw material.

**Keywords:** tomato pomace oil, food waste, sustainability, cosmetics

## REDUCING SUGAR CONTENT IN CAKES

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Obesity, diabetes and other diseases have become a real problem all over the world during recent years. They are caused, among others, by the excessive consumption of sugars in products, which is caused by inappropriate eating habits, as well as nutritional errors. Due to the growing number of consumers who want to reduce sugar consumption, food producers are looking for ways to replace sugar with other compounds. For many people it is easier to reach for low-sugar products as substitutes for e.g. popular sweets than to completely change habits.

In general, there are several ways to lower sugar content and/or the glycemic index of food products, especially confectionery and bakery products: (i) The use of sugar replacers – recognized as food additives; (ii) Sweetening with dried fruits, concentrated juices, etc.; (iii) The addition of vegetables, (iv) The use of wholemeal flours, nuts, whole grains; (v) The use of bioactive peptides. In most cases, it is necessary to specifically adapt the recipes or use completely new recipes. However, the characteristics of ready products usually differ from products with sugar.

Polyols have the greatest potential as sugar substitutes. Among the available polyols, xylitol is the most popular, maltitol has the greatest similarity to sugar, and erythritol has the lowest glycemic index. They all affect the texture of cakes, moisture, taste and color, but depending on the type of cake, the effect is ambiguous.

For example, in the tested sponge cakes, it was found that the samples with the addition of erythritol showed the highest efficiency, and the cakes with maltitol showed the greatest organoleptic similarity to products with sugar. In some products containing erythritol or xylitol, a bitter aftertaste or cooling effect was noticed, unacceptable by some panelists. The best results were obtained when maltitol was added in an amount lower than the added sugar.

**Keywords:** sugar replacement, polyols, sugar-free products, low-sugar cakes

## KEY ELEMENTS TO ACHIEVE SUSTAINABILITY IN FRESHWATER FOOD PRODUCTION SYSTEMS

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Aquatic food will continue to be one of the most important food resources as it provides valuable micronutrients, not readily available in other food stuffs, e.g. vitamin B and D complexes, and omega-3 fatty acids, among numerous others. This sector is also considered to meet the growing global protein demand and assure food security of projected population increase. Among the diverse production systems freshwater aquaculture focuses great attention since fisheries are fully exploited, whereas mariculture has negative impact on benthic systems and on water quality. However, growth of the freshwater aquaculture sector will be possible mainly if sustainable solutions are implemented, such as those included in the SAFE project, i.e.: i) valorisation of solid and liquid wastes (mushroom production, drying technology), ii) provision of sustainable feeds at competitive prices and performance to mitigate production bottlenecks, iii) diversification through the culture of under-represented species (perch, native crayfish), iv) limiting negative impact of freshwater production systems on the environment (biodiversity), locally and through its supply chains, v) increasing profit margins for pond and recirculating aquaculture systems. According to the SCAR-Fish study, freshwater aquaculture not only needs to become more profitable but also must adopt sustainable management practices to lessen environmental impacts. Therefore, the uptake of the solutions must be tested through local and regional scale demonstrations across the EU and compared to largest, fastest-growing and most diverse aquaculture (e.g. in China) in order to improve the sustainability of aquaculture in Asia and the EU by mutual knowledge sharing. Moreover, the solutions should be consulted with citizens to build trust and promote freshwater aquaculture.

**Keywords:** aquatic food, circularity, environmental impact, side streams, sustainable aquaculture.

**Acknowledgment:** The talk is based on the results achieved within the project SAFE. This project has received funding from the European Union's Horizon Europe programme under grant agreement no. 101084549.

## ASPECTS AND BIOACTIVITIES OF POSTBIOTICS: CELL FREE SUPERNATANT FROM LACTIC ACID BACTERIA

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Postbiotics are considered the newest approach to gut health being “a preparation of inanimate microorganisms and/or their components that confers a health benefit to the host” (ISSAP 2021). The functional bioactive metabolites and compounds that interact with the gut microbiota and the immunological system of the host have antibacterial, anti-inflammatory, immunomodulatory, anti-proliferative and antioxidant activities. Other interesting applications of postbiotics are in food industry. Due to their stability across wide temperature and pH ranges of food matrixes, they can be used in numerous kinds of functional foods, or their presence can be found naturally in several fermented-food and beverages. Our attention was pointed to a further novel approach of postbiotics, as bio-preservatives potentially active to extend the shelf-life of food products. The present study investigated a cell-free supernatant mixture (CFSM), obtained from ten lactic acid bacteria (LAB) isolated from different ecosystems, for its broad inhibitory spectrum, diverse bioactivities, safety, good stability to processing conditions and reproducibility. The study provided a detailed screen of the bioactivities and functionalities of a novel CFSM derived from GRAS LAB strains. Firstly, a CFSM was prepared by mixing selected CFSs that possess remarkable antimicrobial activity. Then, the bioactivities, including the antifungal, minimum inhibition concentration (MIC), antibiofilm, cytotoxicity were assessed. Lastly, CFSM’s sensitivity, chemical composition, the stability, and reproducibility were also monitored. Overall, our results showed that the antimicrobial efficiency of individual CFSs was strain-, time-, pH- dependent. The acidic CFSM was efficient against both bacterial and fungal strains, being more effective in preventing (40%) than degrading preestablished biofilm (20%). It was less toxic to HEK-293 cells than to HT-29 cells. Treating with alkaline and enzymes abolished the mixture antimicrobial activity, indicating the compounds were acidic and proteinous. The GC-FID indicates acetic acid as the major short-chain fatty acid. CFSM was reproducible from different batches and exhibited long shelf-life at 4°C. The revealed bioactivities of metabolites, produced by the ten LAB, broaden their versatile food applications as bio-preservatives.

**Keywords:** postbiotic, lactic acid bacteria, cell-free supernatant mixture, antimicrobial, cytotoxicity, biopreservatives

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**KEY DRIVERS IN FOOD SCIENCE  
AND TECHNOLOGY FOR A  
SUSTAINABLE AND SAFE NUTRITION**

**FRUCTANS IN FUTURE FOODS AND HUMAN HEALTH:  
OPPORTUNITIES AND CHALLENGES**

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Both plants and microorganisms have enormous amounts of fructans, which are the non-structural polymers of D-fructose. Fructans may be found in great proportions in both of these types of organisms. On the basis of the correlations that they share, fructans have been classified into three distinct categories: inulin, levans, and graminan. Fructans are being employed in both the food and pharmaceutical industries as a result of their wide range of potential applications. In addition, the food industry makes extensive use of it as a fat and sugar replacement, as well as a prebiotic due to the fact that it cannot be digested, and as a sugar alternative. In addition, fructans have been used as a highly effective functional component for the treatment of a variety of chronic health conditions, including high blood pressure, diabetes, colon cancer, and others. This utilization of fructans has been extremely successful. This talk has been referenced due to the successful chemistry of fructans biosynthesis, its use in the food and non-food sectors, its beneficial effects on health, including the relevance of prebiotics, and its secure nature as well. The speech will provide and appeal to researchers, scientists, and industrial people to explore comprehensively the origins of fructans and their biosynthesis (including growth and degradation), as well as the chemistry, composition, and future essential industrial uses of fructans. Additionally, the toxicological study of fructans as prebiotic or dietary components of food will be discussed in this speech.

**Keywords:** fructans, human health, immunomodulatory effect, oligofructose, prebiotic

## SPRAY DRYING OF PLANT BEVERAGES

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The work aimed to produce powdered plant beverages without the addition of carriers. Soy, almond, rice and oat commercial beverages were spray dried. Additionally, oat beverage was dried after different treatments (concentration, addition of oat fiber) and by two approaches of spray drying (conventional high temperature spray drying – SD, and dehumidified air spray drying at low temperature – DASD). The aim of treatments and change in spray drying approach was to enhance the drying yield. Moisture content, water activity, particle morphology and size of obtained powders were analyzed. Fourier Transform Infrared (FTIR) spectroscopy, coupled with chemometric methods (Principal Component Analysis – PCA and Hierarchical Cluster Analysis HCA) was applied to evaluate the differences in chemical composition among samples. It was possible to produce powders without the addition of carriers. Although the drying yield of four basic beverages was low (16.1-37.4%), for oat beverage it was significantly enhanced by applied modifications in feed material and spray drying process. The highest yield was for drying of concentrated commercial oat beverage dried by DASD approach. Water activity and moisture content of all powders were at low, acceptable level. The median particle size of the powders ranged from 8.2 to 26.8  $\mu\text{m}$ . FTIR analysis revealed differences amongst powdered samples in the range of the absorption frequency of amide I, amide II (1700–1500  $\text{cm}^{-1}$ ) and carbohydrate region (1200–900  $\text{cm}^{-1}$ ).

**Keywords:** plant-based food, spray drying, powder recovery, food powder

## METHOD OF INCREASING THE SAFETY AND FUNCTIONAL VALUE OF CUSTARD

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The functional value and safety of custard can be improved by using natural biocompatible additives, which will protect the product from microbiological risks and fat oxidation. The research conducted by the authors provided a strong justification for the application of grape seed extracts as antioxidant and antimicrobial agents in confectionery creams.

Hydroalcoholic extracts from grape seeds are rich in polyphenolic, which have antioxidant properties and therapeutic effects for the human body. Research has proven that the significant antimicrobial activity against *Escherichia coli*, *Salmonella spp.* and *Staphylococcus aureus* of grape seed extracts is attributed to the properties of polyphenols to affect the integrity of the cell membranes of microorganisms, to inhibit the activity of extracellular microbial enzymes that interfere with microbial growth and replication. Therefore, these biologically active compounds can protect food products from oxidation, preventing the degradation of fats and other sensitive components, can inhibit the development of fungi and microorganisms, and as a result, increases the quality and shelf life of food.

The custard was fortified with different concentrations of dry extracts (from 0.05% to 0.1%) and the sensory properties were evaluated, the basic physicochemical parameters, the antioxidant activity and the resistance of the custard to microbiological degradation were determined. From the point of view of sensory qualities - the custard had a viscous and homogeneous consistency, light creamy color, pleasant smell and taste creamy, sweet, balanced, pronounced taste of butter; grape seed extract gave the cream a light and pleasant nutty flavor. Humidity did not change significantly, with average values of 62÷63% for all samples.

The titratable acidity was within the allowed limits of 1.84÷2.15%, depending on the concentration of the added extract. The value of the peroxide index of the control sample during storage increased 3-3.5 times, while in the fortified samples it increased 1.2-1.5 times and remained within the acceptable limits, the latter being more resistant to oxidation. It was noted that the DPPH antioxidant activity of the cream fortified with 0.1% grape seed extract (55.12  $\mu\text{M TE/L}$ ) was 45 times higher compared to the control sample (1.23  $\mu\text{M TE/L}$ ).

Research has shown that the bioactive compounds in the extracts exhibited antifungal properties and inhibitory effect against gram-positive and gram-negative bacteria. The quantity of mesophilic aerobic and facultative anaerobic

microorganisms in the control sample was  $2 \times 10^4$ , and less than  $5 \times 10^3$  CFU in the cream with natural additives.

It was concluded that fortifying the cream with natural antioxidant extracts improved its functional value. The quality and shelf life of pastry cream have increased, thanks to the properties of grape seed extracts to inhibit free radicals and protect against microbiological decomposition.

**Keywords:** custard, grape seed extract, quality, safety, antioxidant

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## ANTIMICROBIAL ACTIVITY OF YOGHURT MADE USING A MIXTURE OF COWS AND GOATS MILK WITH BERRIES PUREE

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The quality of yoghurt is a priority requirement in the Moldovan economy. In the dairy industry, this requirement is becoming increasingly stringent in order to ensure impeccable sanitary quality and without risk of economic losses. One of the functional properties of yogurt is antimicrobial activity, produced by the fermentation process during manufacture. The existence of antimicrobial activity, using the diameter of the inhibition zone, indicates that the bacteria tested cannot grow around the disk. The ability to inhibit the growth of pathogenic microorganisms is a valuable microbiological property for guarantee the quality and safety of yogurt. The presence of lactic acid bacteria and ingredients of vegetal origin in yogurt have the ability to produce a high number of compounds with antimicrobial activity against certain pathogenic bacteria such as *Bacillus cereus*, *Clostridium botulinum*, *Clostridium perfringens*, *Listeria monocytogenes*, *Staphylococcus aureus*, etc. Some of the most important and well-known compounds involved in antimicrobial activity are organic acids. They inhibit the growth of pathogenic bacteria by modification of the pH, thus providing an acidic environment unfavourable to the growth of the *Bacillus cereus* pathogenic bacteria. In the present research, yogurt was obtained from a mixture of cow's and goat's milk in a ratio of 1:1 with the addition of 10% aronia berries (*Aronia melanocarpa*, variety Nero), raspberry berries (*Rubus idaeus*, variety Cusma lui Guguta) and strawberry berries (*Fragaria xananassa*, variety Selva) under laboratory conditions using the thermostat method. According to the obtained results, the possibility of inhibiting the growth of *Bacillus cereus* pathogenic bacteria presented a valuable microbiological property for ensuring the quality and safety of yogurt. Compared with yogurt without addition, the inhibition zone of yogurt sample with 10% aronia addition increased by 1.8 fold, of yogurt sample with 10% raspberry addition increased by 1.6 fold and of yogurt sample with 10% strawberry addition increased by 1.3 fold. These results were positively influenced by the high biological value of the berries due to the content of organic acids, polyphenols, antioxidants, vitamins, anthocyanins, etc. which contributed substantially to the antimicrobial activity of the yogurt. The addition of ingredients of vegetal origin showed a noticeable effect and good action against of *Bacillus cereus* pathogenic bacteria.

**Keywords:** yogurt, lactic acid bacteria, inhibition zone, bacteria, spoilage

**Acknowledgment:** The research was funded by state project 20.80009.5107.09 «Improving of food quality and safety through biotechnology and food engineering», running at Technical University of Moldova.

## **GUT MICROBIOTA AND ALZHEIMER'S DISEASE: EXPLORING NEW FRONTIERS IN NEURODEGENERATIVE DISORDERS**

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Alzheimer's disease (AD), one of the most common neurodegenerative disorders in the aging population worldwide, is influenced by a complex network of factors in its development. Recent research proposes that the gut microbiota - the community of microorganisms residing in our gastrointestinal ecosystem - may play a role in the onset and progression of AD. These microbial communities can impact brain functions and cognitive abilities through various metabolic and neuroendocrine mechanisms that form the microbiota-gut-brain axis.

Moreover, imbalances in the gut microbiota, known as dysbiosis, are believed to potentially trigger or accelerate the pathogenesis of AD. This can be explained by the increased permeability of the gut and blood-brain barrier resulting from microbial imbalances, which can have adverse effects on brain health and accelerate the development of AD. It is thought that various metabolites produced and secreted by the gut microbiota can influence communication pathways between the brain and gut, thus affecting neuroinflammatory processes.

In light of these observations, it can be inferred that the gut microbiota may serve as a potential target in the treatment and prevention of AD. From this perspective, efforts to understand the gut microbiota of elderly individuals and to determine its role in the development of AD will be crucial for future therapeutic strategies. For example, it is hypothesized that pathogenic microbes increase the risk of AD and personalized diets, or probiotic interventions may aid in reducing the risk of AD. Therefore, gaining a better understanding of the relationship between the gut microbiota and AD will not only allow us to better comprehend the pathogenesis of the disease but also aid in the development of new and effective strategies for the management and treatment of this disorder.

**Keywords:** Alzheimer's disease, neurodegenerative diseases, gut microbiota, neuroinflammation

**IN VITRO ASSESSMENT OF ANTIDIABETIC ACTIVITIES OF  
ENHYDRA FLUCTUANS LEAF EXTRACT FOR FOOD AND DRUG  
APPLICATIONS**

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The use of medicinal plants by millions of people across different traditional systems has led to a surge of interest in substances with antioxidant properties as potential therapeutic and preventive agents. *Enhydra fluctuans* is a common leafy green that can be found in eastern India and Bangladesh and has a long history of being used medicinally by local people and ethnic groups. This ethnomedicinal plant is specially used for the management of diabetes mellitus in rural areas. Therefore, the aim of the current study is to evaluate the *in vitro* qualitative phytochemical and antidiabetic activities. Different phytochemicals were detected using a variety of standard techniques for phytochemical analysis. While a remarkable enzymatic inhibition activity was observed for  $\alpha$ -amylase and  $\alpha$ -glucosidase enzymes, the *in vitro* analysis showed that the *Enhydra fluctuans* leaf has the potential to be an enormous source of antidiabetic phytoconstituents and to serve as an effective therapeutic for future food and drug applications.

**Keywords:** diabetes mellitus, ethnomedicine, *Enhydra fluctuans*, phytochemical analysis, antidiabetic activities

**PHYSICO-CHEMICAL CHARACTERISTICS, BIOLOGICAL  
VALUE, AND ACCEPTABILITY OF QUINCE AND SEA  
BUCKTHORN SAUCES**

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The last two decades have seen considerable research and development efforts dedicated to new food technologies. The main reasons for this interest in new food technologies is the anticipated range of benefits they can bring to consumers and the food sector, and the reduction of the demonstrated negative effects of conventional foods. In this regard, in the study, an integrated technological, physico-chemical and sensory approach was implemented to study the possibility of Sea buckthorn berries and quince fruits use in the production of sauce. Sauce samples were prepared combining different quince/sea buckthorn pulp ratios (100:0; 80:20; 60:40, 50:50). The biologically active potential of the sauces was determined by assessing the total content of polyphenols, vitamin C and antioxidant activity. Thus, the sample with 60g:40c(%) recorded the best values in terms of the total polyphenol content reaching the value of 84,41mg/100 g product and the second highest antioxidant activity of 87.35 %. Vitamin C content ranged between 35 mg/100 g and 70 mg/100 g, being higher in the samples with a greater amount of sea buckthorn pulp. Performing the sensorial analysis, it was deduced that the 60:40% quince:sea buckthorn had the best characteristics for the consumer, but the latter is to be improved because it had a too airy consistency caused probably by the use of immersion blender. Concerning the color parameters, an inversely proportional correlation was established between the brightness (L\*) of the sauces and the amount of added sea buckthorn pulp. In the case of parameters a\* and b\*, the samples with a higher content of sea buckthorn showed a higher red color intensity.

**Keywords:** polyphenols, antioxidant activity, vitamin C, color parameters

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## **CANNABIS SATIVA L. OIL CAKE TECHNOLOGICAL APPLICATIONS**

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The Mondial current food situation is characterized by a decrease in the consumption of basic foodstuffs, since a significant part of the population, due to low purchasing power, cannot provide themselves with the necessary nutrients. In addition, modern people are consuming more refined and deeply processed foods, experiencing an acute shortage of protein, vitamins, macro- and microelements, and other substances. One way to improve food quality and the population's nutritional structure consists in introducing into the diet new non-traditional types of plant materials containing a balanced complex of proteins, lipids, minerals, and vitamins. A potential source of functional ingredients for the food industry are processed oilseeds. Currently, hemp (*Cannabis sativa* L.) seed oil cake is mainly used in feed production as an additive for farm animals feeding. At the same time, the hemp (*Cannabis sativa* L.) seed oil cake is characterized by the presence of food functional substances: proteins with a complete amino acid composition, essential polyunsaturated fatty acids, dietary fiber, minerals – magnesium, phosphorus, manganese, copper, iron, and calcium, which indicates the prospects for its use in the food industry. However, there are a number of technological factors that limit the use of cannabis seed oil cake. One of the main biochemical criteria related to the quality of the seed protein complex is the change in the acid index of the seed oil. With its increase above 1.5-2.0 mg KOH, the total content of crude protein in the seeds decreases, and the processes of hydrolytic cleavage of proteins intensify, which leads to a decrease in the content of digestible and assimilated protein. The same limiting factor in the use of hemp (*Cannabis sativa* L.) seed oil cake as a functional additive in food products is the presence of a large amount of fiber, which gives the product a rough texture and reduces palatability. A promising direction in the processing of hemp (*Cannabis sativa* L.) seed oil cake is its biotransformation using cellulolytic enzymes, leading to a reduction and softening of the seed coats while maintaining all the useful properties of the feedstock.

**Keywords:** *Cannabis sativa* L., oil cake, high-quality proteins, biochemical criteria

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## THE VALORISATION OF GARLIC (*ALLIUM SATIVUM*) BIOLOGICALLY ACTIVE COMPOUNDS

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Garlic has been widely studied over the past two decades. Used as a spice, and as a food preservative to inhibit the growth of pathogens, it is considered a potential functional food because it possesses bioactive properties, playing an important role in controlling health problems. In order to study the biologically active compounds in garlic, three garlic varieties have been chosen: Alcor, Liubasha, Jubileu Gribovschi. The study emphasizes some physicochemical characteristics of garlic in terms of dry matter, sugar content, crude oil, pH, dry matter, ash, and some physical properties such as mass, length, width, and geometrical shape. It was assessed the total polyphenol content in the mentioned garlic varieties was 5.43, 2.08, and 2.35 mg GAE/g respectively. The ability of garlic to speed up the healing of wounds and inflamed mucous membranes is due to the tannins that give it its sharp taste and smell. The content of tannins did not vary significantly ( $p > 0.05$ ) between the three varieties of garlic studied, their average value being 0.21 mg/g. In terms of free radical inhibition, which was assessed by the DDPH method, the Alcor garlic variety exhibited the strongest capacity of 70.90 %. The behavior of some garlic properties during technological manipulation was assessed. Due to some major changes in terms of colour, taste, flavor, and consistency properties during technological manipulation, it was stated that Liubasha and Jubileu Gribovschi varieties should be used only in their raw form. The obtained data allow to state that garlic is an excellent bioactive raw material and the variety Alcor can be used as an ingredient in the development of functional food products.

**Keywords:** garlic, polyphenols, antioxidant activity, tannins

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**SOCIODEMOGRAPHIC, NUTRITIONAL AND HEALTH STATUS  
FACTORS ASSOCIATED WITH ADHERENCE TO  
MEDITERRANEAN DIET IN AN AGRICULTURAL MOROCCAN  
ADULT'S POPULATION**

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**Background.** Numerous studies have demonstrated beneficial effects of adherence to the Mediterranean diet (MD) on many chronic diseases, including chronic kidney disease (CKD).

**Objective.** The aim of this study was to assess the adherence of a rural population to the Mediterranean diet, to identify the sociodemographic and lifestyle determinants and to analyze the association between adherence to MD and CKD.

**Material and Methods.** In a cross-sectional study, data on sociodemographic, lifestyle factors, clinical, biochemical parameters and diet were collected on a sample of 154 subjects. Adherence to MD was assessed according to a simplified MD score based on the daily frequency of intake of eight food groups (vegetables, legumes, fruits, cereal or potatoes, fish, red meat, dairy products and MUFA/SFA), using the sex specific sample medians as cut-offs. A value of 0 or 1 was assigned to consumption of each component according to its presumed detrimental or beneficial effect on health.

**Results.** According to the simplified MD score, the study data show that high adherence (44.2%) to MD was characterized by intakes high in vegetables, fruits, fish, cereals, olive oil, and low in meat and moderate in dairy. Furthermore, several factors such as age, marital status, education level, and hypertension status were associated with the adherence to MD in the study population. The majority of subjects with CKD have poor adherence to the MD compared to non-CKD with a statistically insignificant difference.

**Conclusions.** In Morocco, maintaining the traditional MD pattern play crucial role for public health. More research is needed in this area to precisely measure this association.

**Keywords:** mediterranean diet, chronic kidney disease, simplified MD score, Morocco

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## MODERN STRATEGIES FOR USING THE POMACE RESULTING FROM THE PROCESSING OF VEGETABLE PRODUCTS IN VALUE-ADDED PRODUCTS

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One of the main problems people are currently facing is waste management. A substantial amount of the world's waste is produced by agro-industrial byproducts that result from the industrial processing of products derived from agriculture. Pomace, peels, and seeds are examples of processed byproducts that are high in biomass and include a variety of essential nutrients like proteins, carbohydrates, minerals, etc. These byproducts could prove to be excellent, cost-effective raw materials for developing value-added products like pigments for various industrial and therapeutic applications. Pomace is the byproduct that forms after vegetable juice production. Carrot and beet pomace, which are byproducts after processing in juice factories, are typically thrown out as industrial waste or used as animal feed, even though they contain high levels of beneficial compounds like carotenoids, minerals, vitamins, betalains, antioxidants, dietary fibers. The practical method for extending the shelf life of perishable pomaces for future use is drying or dehydrating them. Due to its composition, pomace as a whole has the potential to be utilized as a functional ingredient in food. Dry pomace can be used as a source of dietary fiber and other bioactive components in a variety of food products. Because pomace powder has so many useful features including the ability to hold and retain water, to swell, and to absorb oil, it is frequently used in a variety of food products (cookies, snacks, and candies). Thus, vegetable pomace has been used in a variety of value-added products, including bread, pasta, biscuits, cakes, dressings, and cookies, and for the development of functional beverages. Vegetable pomace can be used as a cost-efficient and useful functional ingredient.

**Keywords:** vegetable pomace; carotenoids; betalains; functional properties; value-added products

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## EVALUATION OF CAROTENOIDS, PHENOLIC COMPOUNDS, AND ANTIOXIDANT CAPACITY OF DIFFERENT VARIETIES OF PUMPKIN PEELS

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Pumpkin fruits (*Cucurbita maxima*) have been consumed widely over the globe, and their preparation produces huge amounts of seeds, peels as byproducts. Pumpkin peels offer important bioactive components (carotenoids, vitamins, and dietary fibers) that give them biological and pharmacological capabilities in addition to a balanced nutritional profile. Pumpkin by-products phytochemicals (carotenoids) provide remarkable added value to foods associated with antioxidant and anti-inflammatory activity, antibacterial, cardiovascular disease protection, and anti-cancer properties. In the present study, the phytochemical composition and antioxidant activity of the pumpkin peels obtained from two widely consumed varieties in Romania were analyzed, namely, the White Pie Pumpkin (from Plovdiv) (PP1) and the Waltham Butternut Pumpkin (PP2). The total carotenoids were extracted using ultrasound-assisted extraction while the amount of phytochemicals in pumpkin peels powder (PPP) was subsequently determined spectrophotometrically using the obtained dry extracts.

The total carotenoid content of extracts was  $1.389 \pm 0.089$  mg/g in the case of PP2 and  $16.946 \pm 0.810$  mg/g in PP1. Regarding the  $\beta$ -carotene content, the average value was  $1.207 \pm 0.086$  mg/g for PP2 and  $14.687 \pm 0.736$  mg/g for PP1. For the content of polyphenols, an average value of  $6.968 \pm 0.635$  mg GAE/g dw was obtained for PP2, being lower compared to the average value identified for PP1 ( $8.949 \pm 0.746$  mg GAE/g dw). The extract showed a DPPH radical scavenging capacity of  $20.087 \pm 0.310$   $\mu$ Mol Trolox/g for PP1 and  $4.523 \pm 0.442$   $\mu$ Mol Trolox/g for PP2. The present study highlights the fact that pumpkin by-products have valuable phytochemical content, but this can be influenced by several factors. The phytochemical composition of pumpkin peels is a complex interaction between genetics, environment, processing, and storage conditions.

**Keywords:** by-products; carotenoids; pumpkin peels; phytochemicals; antioxidant activity

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## THE USE OF SEA BUCKTHORN IN THE MANUFACTURE OF BERRY SAUCES

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One of the promising areas for the use of sea buckthorn berries is the production of purees and sauces. In the production of berry sauces, various technologies are used to prepare raw materials for extracting puree, including heat treatment, mechanical processing and fermentation, as well as various preservation methods, the most common of which are pasteurization and the use of preservatives. To improve the organoleptic characteristics, dyes and flavors are used, often of a synthetic nature or identical to natural ones. All of the above manipulations not only reduce the biological value of berry sauce, but also increase the risk of allergic reactions, thereby preventing this type of product from being included in a number of functional and beneficial for human health. We studied the possibility of obtaining sauces of three types based on local varieties of sea buckthorn. The biochemical composition of sea buckthorn berries was studied, the method of blanching berries and storage of the finished product was selected, allowing to preserve the entire range of biologically active substances, a product with increased biological value was obtained, and the quality indicators of sauces were studied. As a result of studies of the physicochemical and biochemical parameters of sea buckthorn berries, as the main raw material for sauces, it was found that the studied varieties contain (depending on the variety): 19-22 % solids, 25-100 mg/% ascorbic acid, 13-29 mg/% carotenoids. The increased content of sugars (6-13.0 %) and the content of acids from 1.6 to 3.2 % determine the specific balanced taste of the finished product. The high content of antioxidants in berries and the percentage of inhibition determined using the DPPH method, varying from 50 to 70 %, allows us to conclude that sea buckthorn has a high antioxidant activity. The resulting 3 types of sauces – sweet, sweet and sour and spicy have high quality indicators, have a pleasant, bright appearance and color, thick texture, balanced taste. Thanks to the gentle method of short-term blanching of berries, and the use of a new alternative method of preservation at low temperatures, it was possible to preserve vitamin C and carotenoids in the finished product. In the course of determining the microbiological characteristics of sauces during their storage for 3 months at a temperature of -20 °C in frozen form, it was found that the total maximum amount of QMAFAnM did not exceed  $2 \cdot 10^3$  CFU/g, which, according to regulatory documents, is a good indicator of safety.

**Keywords:** berry sauce, sea buckthorn, quality, safety, antioxidant, bioactive compounds

**Acknowledgment:** The authors would like to thank the Moldova State project 20.80009.5107.13 Elaboration of the technology for the production of sea buckthorn in ecological system and of the processing of fruits and biomass

## PERSPECTIVE OF USING ZIZIPHUS JUJUBA MILL IN THE PRODUCTION OF MARMALADE-PASTILE PRODUCTS

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The technology for the production of marmalade and pastile occupies a fairly strong position in the jelly group of confectionery products. A promising solution to use as the main raw material can be the culture of jujube *Ziziphus jujuba* Mill., as a highly valuable raw material that has both nutritional and biological value equally, containing natural fruit sugars, protein, fat, ascorbic acid, vitamin PP,  $\beta$ -carotene, catechins, leucoanthocyanins, as well as a large amount of pectin.

The main physico-chemical parameters of fruits of jujube varieties Ta-Yang-Zao and Ya-Zao, selected in the course of research on an experimental plot of gardening in the Denchen district, the Republic of Moldova, were studied, and recipes were developed for obtaining marmelade-pastile products with a ratio of apple puree and jujube puree - 80:20, 50:50, 20:80, with the use of natural dye from the safflower petals. Safflower petals are a perspective source of yellow and red food dyes. It is also known that the yellow dye (YFDS), chalcones nature have high biological activity. Separation of yellow and red dyes from the petals of safflower was performed by extraction; after separated, the YFDS liquid concentrate was evaporated at dried under vacuum. The resulting samples of marmalade-pastile products containing YFDS were analyzed by the HPLC method, as a result, it was proved that the peaks of the three main chalcons from YFDS (HSYA, AHSYB, precartamin), had the same retention time and area of concentration as the YFDS samples. These data confirm, that YFDS has high thermal stability and allows you to save an attractive color of the obtained products. As the most important indicators of *Ziziphus jujuba* Mill. for the production of marmalade and pastille products, the content of sugars, which amounted to 20-25%/mass, of vitamin C, the content of which in jujube fruits exceeds that in apples by more than 4 times and amounted to 70 – 75 mg/100 g, pectin substances, the content of which was 0.40-0.50%/mass., as well as the degree of esterification of pectin, which was 40-46%, depending on the variety. The last two indicators are key, since the mechanism of gelling, and, consequently, the gelling ability, depends on them.

The resulting samples of marmalade-pastile products have high quality indicators, have a pleasant, bright appearance and color, ideal textural characteristics, and a balanced taste. During the study of the final product during its storage for 30 days at a temperature of  $+2\pm 10^{\circ}\text{C}$ , QMAFAnM did not exceed  $3 \cdot 10^3$  CFU/g, which is a good indicator of safety. The highest complex quality indicators were noted for marmalade at a ratio of apple puree and marmalade puree 50:50. This type of product has a high biological value, low energy value due to the exclusion of the use of sugar in the

recipe, a bright color that provides a natural dye obtained from safflower petals, which allows positioning this product as a dietary product and classifying as a group of bio-products.

**Keywords:** berry sauce, sea buckthorn, quality, safety, antioxidant, bioactive compounds, YFDS (yellow food dye from safflower)

**Acknowledgment:** The authors would like to thank the Moldova State project 20.80009.5107.13 Elaboration of the technology for the production of sea buckthorn in ecological system and of the processing of fruits and biomass

## **MICROWAVE-ASSISTED DRYING OF MANGO PEELS: DRYING KINETICS AND OPTIMIZATION OF PROCESS CONDITIONS USING MATHEMATICAL MODELS AND RESPONSE SURFACE METHODOLOGY**

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The effects of microwave drying (MWD) on the drying kinetics, phytochemical characteristics, and antioxidant activity of control and steam blanched mango peels were investigated for the first time through this work. Peels of uniform thickness (~1.5 mm) were used for drying experiments using 3 microwave power levels (360 W, 540 W and 720 W) for 7-9 minutes. The experimental data were best fitted using mathematical models (Page, Henderson and Pabis, Peleg and Lewis). The Page and Peleg models ( $R^2 = 0.99$ ) provided the best fit to the mango peel drying curve. To produce dried mango peel powder and its valorization, the trial runs for process parameters (microwave power and time) were performed using CCRD (Central Composite Rotatable Design). The responses measured were moisture content, drying rate, color, TPC, TFC, DPPH and FRAP. The results of the experiment were accurately predicted by a quadratic model with significant  $R^2$  values, according to ANOVA. The ideal drying operation parameters for MWD of mango peels were proposed to be 720 W and 7.5 minutes. Many validation runs were conducted at the achieved optimum parameter values to verify the precision of the forecasts and the applicability of the models. Response Surface Methodology (RSM) responses under ideal conditions were in good agreement with experimental results and had a low relative deviation level of 0.015–0.414. At the optimized condition, TPC (112.088 mg GAE/g), TFC (189.116 mg QE/g), FRAP (15774.380  $\mu$ g TE/g) and DPPH (9.083 mg GAEAC/g) values were obtained.

**Keywords:** Mango peel, microwave drying, drying kinetics, antioxidant activity

**Acknowledgment:** The authors would like to thank Department of Agricultural and Food Engineering, IIT Kharagpur for providing the facilities and the required instruments.

## GLOBAL FOOD MARKET IN CRISIS SITUATIONS. LESSONS FOR THE FUTURE

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Crisis situations can have a global impact on food security. The paper proposes an analysis of the global food market in critical situations. Clarivate Analytics, SCOPUS, Google Scholar and ResearchGate were used for references. The data required for the research were collected from the official information provided by the World Bank, FAO - UN, Eurostat. The results showed that there is a great vulnerability of the global food market to critical situations. The effects of COVID 19 or the War in Ukraine were quickly felt globally, in the context of climate change. COVID-19 has affected the world's socio-economic and food security and shown vulnerability to pandemic crises. Airline shutdowns, national and international restrictions and lockdowns have severely affected the food supply chain. Russia's aggression in Ukraine has had a strong impact on the world food market. Rapid results were felt, with food, fuel and fertilizer costs rising to record levels in early 2022. Structural weaknesses in the global food system, manifested at production, distribution, access and stability in the food chain, have led many people globally to face situations of food crisis and acute hunger. The occurrence of incidents is becoming cyclical with effects on global food security and is very likely to become more frequent in the near future. National or regional agri-food systems must increase their resilience to face critical situations. International bodies need to create new programs or improve existing ones, with a focus on strengthening social safety nets and policies to help address the impact of the food crisis.

**Keywords:** global market, food security, crisis

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## FOOD LOSS AND WASTE. A GLOBAL APPROACH

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Food waste and loss have economic and social implications and a significant environmental impact. About a third of the food produced globally is wasted, while populations in many areas of the world suffer from hunger and food insecurity, and agricultural production is one of the main sources of pollutants globally, with significant effects on the carbon footprint and of environmental pollution. The paper proposes an analysis of food waste at the global level, focused on causes and effects. Clarivate, SCOPUS, Google Scholar and ResearchGate were used for references. The data were collected from official information provided by the World Bank, the Food and Agriculture Organization of the United Nations, the European Commission, the Ministry of Agriculture and Rural Development. The research found that FLW is a global phenomenon, occurring at various stages of the food chain, including production, processing, distribution and consumption. There are different definitions and acceptances for the terms loss or waste. Important aspects related to the impact of food waste on global food security were highlighted, with increased pollution, depletion of natural resources and valuable energy sources, considerable human, material and economic costs. Minimizing food waste could substantially improve food security, with important favorable effects on the quality of the environment and the living conditions of the population.

Reducing food waste involves both individual and collective action, including consumer education programs, improving harvesting, storage and transportation infrastructure, processing and distribution, promoting food donation, and developing effective policies and regulations. The rational management of food is essential for building a sustainable and equitable food system.

**Keywords:** FLW, food security, pollution, environment

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## COMPARATIVE ANALYSIS OF WILD AND CULTIVATED ROSEHIPS FOR USE IN DAIRY PRODUCTS

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The aim of this study was to compare the composition of wild (from the region of Kiustendil, 2022 crop) and cultivated rosehips (Plovdiv-1 from the region of Gotse Delchev, 2022 crop) and to evaluate their potential use in dairy products. For this purpose, the glyceride oil was obtained by cold pressing. The rest of the rosehip fruits was processed to rosehip flours. In order to be characterized, the rosehip flours and glyceride oils were analyzed. The results from the chemical analysis demonstrated that the cultivated rosehips possessed more fibers. They were richer in minerals and characterized by lower fat content. The glyceride oils from cultivated rosehips were more abundant in polyunsaturated fatty acids but were similar in their tocopherol content. The wild type had higher vitamin C content. The rosehips Plovdiv-1 were characterized by more pronounced antioxidant properties. Concerning their morphological characteristics, it was established that the fruits of cultivated rosehips were longer, with less seeds and hairs which made them suitable to be used in dairy products. The results from the antimicrobial activity demonstrated that both extracts possessed significant inhibitory activity against the Gram-positive microorganism *Micrococcus luteus* 2YC-YT, moderate inhibitory effect on *Bacillus subtilis* ATCC 6633, *Listeria monocytogenes* NBIMCC 8632, *Escherichia coli* ATCC 25922, *Proteus vulgaris* ATCC 6380, *Pseudomonas aeruginosa* ATCC 9027 and low inhibitory activity against *Bacillus amyloliquefaciens* 4BCL-YT, *Staphylococcus aureus* ATCC 25923, *Enterococcus faecalis* ATCC 19433, *Salmonella enteritidis* ATCC 13076, *Salmonella typhimurium* NBIMCC 1672 and *Klebsiella pneumoniae* ATCC 13883. The extracts did not show antifungal activity, except against *Rhizopus* sp. and *Fusarium moniliforme* ATCC 38932, in which the inhibitory activity was low. In conclusion, the cultivated rosehips fruits were a good source of dietary fibers and polyphenols and could be successfully applied in dairy technologies in order to enrich the polyphenolic content and to fortify the final product in vitamins and minerals. The higher antioxidant activity in combination with the demonstrated composition and antimicrobial properties showed the potential to obtain functional dairy products with the application of rosehips. The low pH of rosehips, as well as their microbiological load is a technological challenge.

**Keywords:** rosehip oil and flour, wild and cultivated rosehip, rosehip dairy, antimicrobial rosehip

## LEGUMES - POTENTIAL SOURCE OF ANIMAL ORIGIN RAW MATERIALS REPLACEMENT

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Global forecasts of population growth in the near future involved an increase in the food products demand. As food production increases, sustainability issues are expected, particularly in the production of high-quality animal protein. Animal husbandry contributes to the increase in greenhouse gas emissions, and water resources are depleted because of this. Life needs protein; thus, it is obvious the need to use the available food resources as efficiently as possible, and reducing the consumption of animal proteins by replacing them with those of plant origin would be a good solution. Legumes are appreciated in the food industry due to their energy supply, significant intake of proteins, carbohydrates, dietary fibers, minerals that could be a suitable plant source to replace the animal proteins.

The varieties of chickpea and soybean were used for the research. The content of dry matter, proteins, amino acids profile and minerals, mass per 1000 grains, grains hectolitre mass, acidity of dried legumes were determined.

The results obtained, regarding the chemical composition, demonstrated that all the analyzed legume varieties are potential sources of valuable macro and micronutrients. For chickpea and soybean, close values were obtained for the dry matter content.

The soybean varieties presented the highest protein content compared to the chickpea samples. The amino acid profile showed the same trend for all analyzed legumes. Significant amounts were obtained for (in descending order): glutamic acid, aspartic acid, arginine, lysine, leucine, proline. Among the minerals determined in the dry samples, potassium content was the highest, followed by magnesium and calcium content. The lowest content refers to manganese.

The chickpea samples showed a high content of the potassium, manganese and iron. The 1000 grains mass and hectolitre mass showed that legumes were of high quality, well developed, grown in appropriate conditions. The legumes acidity was low, it could be influenced by the amino acid content.

The obtained results demonstrate that the analyzed legumes are rich sources of proteins, essential amino acids and mineral salts, important in human nutrition and can be used as vegetable sources to replace animal origin proteins in food products manufacture intended for different categories of consumers.

**Keywords:** legumes, soybeans, chickpeas, protein, amino acid's profile

**Acknowledgment:** Moldovan-Turkish Bilateral Project Sustainable Nutrient-Rich New Generation Food Products Development: evaluating the relationship between ingredients, processing methods used, and techno- and bio-functional properties

## THE INFLUENCE OF ADDITIVES ON THE AQUAFABA QUALITY

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Aquafaba is a plant-based by-product with special foaming and emulsifying properties obtained by boiling legumes. The quality of these properties depends a lot on the quality of the legumes soaking and boiling process. In this context, the scientific work aim is to analyze the foaming and emulsifying properties of chickpea aquafaba.

The varieties of chickpea were used for the research, that were soaked in different additives at different concentrations: salt and baking soda (0.5%, 1.0%, 1.5%, 2.0%, 2.5%), citric acid (0.25%, 0.5%, 0.75%, 1.0%). The foaming, emulsifying abilities and stabilities were determined.

The obtained results demonstrated that aquafaba samples with the use of additives in comparison with the blank sample presented higher results for the analyzed indicators. The best results were obtained for aquafaba obtained from chickpea soaked in baking soda with a concentration of 1.5% and salt with 2.5% concentration. In the case of using baking soda, the foam volume increased by 42% and the foam stability for 60 minutes decreased by 11.6%. In the case of aquafaba samples with the use of salt as an additive - the volume of the foam increased by 31.42% and the foam stability during 60 minutes decreased by 7.9%. The results regarding the emulsifying capacity and the emulsion stability were the highest with small deviations in both cases. For the samples of aquafaba obtained from chickpea soaked in citric acid, lower values were obtained compared to the other samples. At the maximum acid concentration, the foam volume increased by only 28.6% and the foam stability over time decreased by 20%. Emulsifying capacity and the emulsion stability was reduced by 32% and respectively 51.4%, compared to the samples where salt and baking soda were used.

Analyzing the obtained results, it was identified that soaking the chickpea grains in salt or baking soda solutions will contribute to obtaining an aquafaba with increased foaming and emulsifying properties, which will contribute to obtain plant based confectionery products with improved quality properties.

**Keywords:** chickpeas, additives, aquafaba, emulsifying properties

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## CYTOTOXIC EFFECT OF SYNTHETIC ANTIOXIDANTS BHA AND BHT ON HEK-293 HUMAN EMBRYONIC KIDNEY CELLS

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Butylated hydroxyanisole (BHA) and butylated hydroxyl toluene (BHT) are GRAS-class phenolic food preservatives, structural analogs of vitamin E, and are the most widely used synthetic antioxidants. They maintain their antioxidant properties and structural stability at high temperatures. Here, the cytotoxicity of the use of BHA (Butylated hydroxyanisole) and BHT (butylated hydroxyl toluene) at maximum limits in sunflower oil according to the Turkish Food Codex was investigated. HEK-293 human embryonic kidney cell lines were propagated in a laboratory environment under appropriate conditions by adhering to the protocol, supported by the literature. The present study aimed to assess the cytotoxic impact of BHA and BHT at varying concentrations. BHA was tested at concentrations of 10, 50, 100, 500, and 1000 µg/mL, while BHT was examined at concentrations of 10, 50, 100, 500, 1000, and 5000 µg/mL. To determine the cytotoxic effect, the cells were exposed to these concentrations of BHA and BHT for 24, 48, and 72 hours. Cellular responses were then evaluated and the collected data were used to measure IC<sub>50</sub> concentrations of BHA and BHT. The IC<sub>50</sub> values were calculated using the Calcsyn program. Findings analyzed at p<0.05 significance level in GraphPad Prism program, based on control group viability level of 100%, for BHA, a significant difference was observed at 10, 50, 100, 500, and 1000 µg/ml concentrations at 24, 48 and 72 hours. For BHT, a significant difference was observed only at 50 µg/ml at 24 hours. The IC<sub>50</sub> doses of BHA and BHT at 72 hours were calculated as 8.75 µg/ml and 1761,159 µg/ml, respectively. It has been shown that a cytotoxic effect was observed on HEK-293 (Kidney epithelial cells) when certain portions are consumed, within the framework of the assumptions specified in the 24-hour period.

**Keywords:** HEK-293, synthetic antioxidants, BHA, BHT, cytotoxicity

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## BEHAVIOUR OF SOLUTIONS OF WHEY PROTEIN CONCENTRATES UPON HEAT TREATMENT

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The purpose of the present study was to assess the behavior upon heating of three types of non-cow Whey Protein Concentrates (WPC\_EP) with 80, 65 and 50% crude protein content manufactured from Feta cheese whey. Solutions (8% w/w) of the three types of WPC\_EP were treated under batch conditions at 72, 74 and 76 °C for 10 min, under constant pH 6.8 with or without the addition of trisodium citrate as chelator. A commercial WPC of cow origin with 80% crude protein and liquid defatted sheep and cow whey were studied under the same conditions. The assessment was performed after immediate cooling of the heat-treated solutions and focused on the formation of aggregates at pH 6.8 and after post-heating acidification at pH 4.6. It was based on: i. the profile of particle sizes using a Laser Diffraction Particle Size Analyzer, and ii. the changes of turbidity at 600 nm. The increase of crude protein content, the non-cow origin of the sample and the post-heating acidification induced or increased the turbidity and aggregation level. The addition of the chelator reduced dramatically the turbidity of heated solutions and the size and distribution width of particles in them, with the exception of WPC\_EP\_80. The solutions of WPC\_EP\_50 with the lowest crude protein content was the most stable in terms of aggregation under the conditions utilized in the present study.

**Keywords:** whey, WPC, heating, chelator, aggregation

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## PROPERTIES OF PLAIN DRINKING YOGHURT MADE WITH ACID WHEY FROM GREEK YOGHURT

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Drinking yoghurts products are often manufactured by diluting yoghurt with water. Acid whey (AW) removed during strained yoghurt production is considered environmental pollutant. Hence, the purpose of this study was to use the yoghurt AW as dilution medium to produce plain drinking yoghurt (DY) in the framework of circular economy. Six different DY products were manufactured using two different yoghurt cultures (A and B). Incubation took place at 42°C for 4h. Then the two initial yoghurts were diluted with water at a ratio 1:1 (control products Aw and Bw), or with water and AW at ratio 1:1 (50% substitution of water with AW, products Aw-aw and Bw-aw) or with only AW at a ratio 1:1 (products Aaw and Baw). Results showed that pH of products B was higher than pH of products A and remained constant from 1d to 20d of storage. The use of AW instead of water resulted in significantly ( $P<0.05$ ) higher carbohydrates, ash and total solids contents in products Aaw and Baw compared to the others. In all products, yoghurt lactococci counts ranged from 8.20 log CFU/g to 8.58 log CFU/g throughout the 20 days of storage, whereas lactobacilli counts ranged from 4.66 log CFU/g to 6.66 log CFU/g at 1d and decreased about 2 log cycles at 20 days. Regarding the physical properties of the products, dilution with AW did not affect significantly ( $P>0.05$ ) the color parameters. Viscosity in the case of culture B was significantly higher in the products containing AW (67.77 -70.33 mPa.s) at 1d, but it was decreased at similar values with those of products with water (45.33 - 49 mPa.s) at 20d. Products containing only AW (Aaw and Baw) showed lower serum separation degree compared to all other products. Finally, using a consumer acceptance test all products were scored similarly for their appearance, color, flavor/odor, taste, acidity, viscosity and overall acceptance. In conclusion, it is possible to produce drinking yoghurt using the acid whey from Greek strained yoghurt and this could be feasible especially for small yoghurt industries.

**Keywords:** acid whey, drinking yoghurt, Greek yoghurt

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**THE IMPACT OF PULSED ELECTRIC FIELD (PEF) PRE-TREATMENT ON SELECTED PROPERTIES OF DRIED STRAWBERRIES PROCESSED BY ULTRASOUND-ASSISTED CONVECTIVE DRYING**

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Drying is one of the most important food processing methods that aims at reducing the amount of water in the food product and extending its shelf life. At the same time, it is extremely energy-consuming process that may negatively affect the product quality. Therefore, significant advances in this area e.g., different sources of heat during drying or various pre-treatments techniques, have been studied. The purpose of this study was to analyse the impact of pulsed electric field (PEF) energy and the ultrasound (US) power on selected properties of dried strawberries obtained by PEF pre-treatment prior ultrasound-assisted convective drying.

The strawberry slices were subjected to PEF (specific energy input of 0.065, 0.433 and 0.800 kJ/kg) and ultrasound-assisted convective drying (temperature of 70°C, air flow of 1.2 m/s, US power of 120, 160 or 200 W). Then, dry matter content, water activity, hygroscopicity, rehydration rate and microstructure were analyzed. The values of the dry matter content varied from 91.5 to 94.6%. The statistical analysis showed that the effect of PEF pre-treatment was statically significant whereas the power of US did not show the statistical significance. Water activity reached values well below 0.6 which means all samples can be considered as microbiologically safe. Water vapour adsorption within 24 hours caused an increase in water content of strawberries that resulted in the final water content in the range of 38.3-67.9 g/100 g of dry matter. For all tested samples the rehydration rate was from 2.68 to 4.50. The highest value of the hygroscopic properties and simultaneously the lowest rehydration rate were obtained for sample treated with PEF of 0.433 kJ/kg and US of 120 W. Additionally, both PEF and US techniques caused the deformation of strawberry microstructure and the higher PEF energy and US power were used, the more intensive damages were observed.

**Keywords:** strawberries, pulsed electric field, ultrasound-assisted convective drying

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**EXTRACTION AND CHARACTERIZATION OF BIOACTIVE COMPOUNDS FROM *PRUNUS SPINOSA L.* FRUITS WITH POTENTIAL IN THE DEVELOPMENT OF EDIBLE FILMS WITH MULTIPLE FUNCTIONAL PROPERTIES**

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*Prunus spinosa L.* fruit, commonly known as blackthorn, is a rich source of bioactive compounds, including flavonoids, anthocyanins, phenolic acids, vitamins, minerals, and organic acids, which exhibit significant antioxidant and antibacterial properties. Notably, flavonoids such as catechin, epicatechin, and rutin have been reported to have protective effects against diabetes, while other flavonoids, including myricetin, quercetin, and kaempferol, exhibit antihypertensive activity. Solvent extraction methods are widely used for the extraction of phenolic compounds from plant sources, owing to their simplicity, efficacy, and broad applicability.

The aim of this research is to conduct a complete analysis of the biologically active chemicals, highlighting their principal effects on the body and capitalizing on the therapeutic effects of blackthorn fruits.

According to the results of the tests, both the blackthorn and the freeze-dried powder derived from them contain a substantial level of antioxidants. They also have an inhibitory impact on *S.aureus* bacteria, hence it was decided to create a biofilm with blackthorn extract to increase the shelf life and stability of food products.

**Keywords:** antioxidant; antibacterial properties; bioactivities; blackthorn; *Prunus spinosa L*

## **BI-, OLEO- AND EMULGELS WITH SEVERAL FOOD APPLICATIONS**

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In recent years, extensive research has been conducted on the applicability of bi-, oleo-, and emulgels, revealing several advantages over conventional fats, such as increasing the unsaturated fat content of products. Gels can be used as fat replacer for the total or partial replacement of saturated and trans fats in the meat, bakery and pastry industry. The aim of this study was to provide a synthesis of the research results when gels have been used in various categories of food products. In the process dynamics of oleogel-based tender dough products, the behavior of refined sunflower oil structured with various agents (carnauba wax,  $\beta$ -sitosterol: beeswax,  $\beta$ -sitosterol: lecithin and glycerol monostearate) was assessed. Also, the puff (jam stuffed puff pastry) and tender pastries (bow tie cookies, cheese crackers, apple pie, and cookies) have been reformulated by completely replacing conventional fats with oleogel and the structural behavior of the technological process was evaluated. Using a three-level, two-factorial design, shellac wax-based emulgels were investigated to determine the optimal formulation for a spread composition. Through the repeated consumption of meat products, some health problems may arise related to their fatty acid composition, so consumers are more focused and choose food products formulated with alternatives to conventional fats. In order to improve the nutritional profile, pork backfat was replaced with oleogels in Bologna and Traditional Romanian sausages. In addition to satisfying the need for the enrichment of foods with unsaturated fatty acids, the substitution of conventional lipids with the new bigels systems could be a viable alternative in confectionery technology for the production of low-caloric products. Therefore, gels are effective, innovative and sustainable alternatives to conventional fats.

**Keywords:** foods, bigel, replace, fats

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## EFFECT OF GRAPE SKIN INCORPORATION ON OXIDATIVE STABILITY OF ICE CREAM

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Grapes harvested worldwide are used in winemaking, and with the development of this industry, the volume of accompanied by-products increases, such as grape pomace, seeds, etc. These products are rich in polyphenols, tannins, and others, thus are of great interest for their subsequent exploitation. The paper explores the possibility of using grape skin powder as an addition to the production of ice cream. In order to achieve the objective of the research, influence of the addition of grape skin powder on the quality indices of ice cream was assessed. Ice cream samples were fortified with grape skin (GS) with the following combinations: 0 % GS, 2.5% GS, 5.0% GS, 7.5% GS and at 10.0% GS. The fortification of the ice cream with grape skin was done by reducing the amount of sugar in the 2.5 and 5.0% GS samples and including the amount of sweet cream for the 7.5 and 10.0% GS samples. The lipid content varied between 23.86 – 26.25 % for the ice cream samples. The acidity and peroxide index were determined for the ice cream samples: on the day of preparation, over 2 weeks and over a month after manufacture. Research has shown that the acidity index varied from 0.16 g acid/100g product at the time of manufacture to 0.23 g acid/100g after one month of storage in the control sample, and the same values were 0.1 g acid/100g and respectively 0.16 g acid/100g for the sample with 5% of GS. The peroxide index for the control reached values of 1.3 meqO<sub>2</sub>/kg for the first day and 1.9 meqO<sub>2</sub>/kg after one month of storage, while for the sample with 5% GS it was 1.3 meqO<sub>2</sub>/kg and 1.5 meqO<sub>2</sub>/kg respectively. Research has shown that the addition of grape skin powder reduces the rate of oxidative processes in ice cream samples, and significantly contributes to increasing the total polyphenol content (63.93 - 139.29 mg GAE / mL extract) and antioxidant activity (33, 63% for sample 10.00 % GS). Also, the fortification of the ice cream with grape skin powder significantly influences the color of the elaborate ice cream, the color difference varying in the limits  $\Delta E = 37.37 - 54.94$ . It has been established that the incorporation of grape skin powder into ice cream formulations up to 5% has a microbiostatic effect, and as its concentration increases, an antagonistic effect is manifested.

**Keywords:** grape skin, ice cream, acidity index, peroxide index, polyphenol

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## COMPARATIVE ASSESSMENT OF BIOACTIVE COMPOUNDS IN DRIED CHERRY TOMATOES UNDER DIFFERENT CONDITIONS

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Cherry tomatoes (*Solanum lycopersicum* var. *cerasiforme*) are consumed worldwide as fresh vegetables due to their high content of bioactive compounds (vitamins, proteins, essential amino acids), antioxidants, minerals, fibers and a high moisture content (around 90%). Being a perishable product, it is necessary to be processed to benefit of all the functional properties and not at least to prevent the waste.

In the present study, the impact of air forced convection and hot air-infrared drying methods are investigated on physical and phytochemical properties of cherry tomatoes samples. Three ranging drying temperatures (50, 60 and 70°C) were used for both drying methods.

The specific parameters for color (L, a, b) were analyzed using the CIELab system and the spectrophotometric analysis was used to determine the antioxidant capacity, total polyphenolic and flavonoid contents, total carotenoids as well as,  $\beta$ -carotene and lycopene content.

The results showed the differences in color between forced convection and hot air-infrared dried cherry tomatoes samples. The values registered for the color parameters are not directly influenced by the drying techniques.

The total phenol content and antioxidant activity exhibit the highest results for forced convection dried samples at 60°C (3.96±0.11 mg AG/g DW, respectively 88.05±1.91% inhibition of ABTS radical), while the beta-carotene and lycopene content registered the highest values for IR dried samples at 60°C (11.67±0.29 mg/g DW and respectively 7.10±0.16 mg/g DW).

Notably, drying at 60°C both by forced convection and hot air-infrared allows keeping a higher content of bio nutritive compounds compared to the other temperatures.

**Key words:** infrared, convection drying, antioxidant activity; total polyphenols, lycopene.

## **SURVEY ON LIFESTYLE AND EATING BEHAVIOR OF ADULTS**

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Lifestyle and balanced diet represent a topic of interest for both specialists and the average person in the context of increasing evidence that adopting a healthy lifestyle is an effective strategy for successful ageing. This is related to health duration and life expectancy that can be improved by changes in lifestyle factors such as diet, physical activity, hydration, rest, smoking and environment.

The purpose of the research was to identify the eating habits and daily behaviors of adults that can influence the duration of health and life expectancy. The data was obtained by using a structured questionnaire disseminated through social networks between February and March 2023, in the south-eastern area of Romania. The questionnaire included 33 questions and the number of the respondents was 523. The aim of the survey was to identify the frequency at which certain foods and drinks are consumed, the daily level of hydration and physical activity, resting level, the concern regarding the state of health, awareness of the need for prevention and daily habits with an impact on health.

Following the results obtained and analyzed in this research, it was noticed that overweight, a risk factor for conditions that can reduce the duration of health and life expectancy, is a current issue in our country. More than half of the participants have a body mass index that does not correspond to a normal weight, and in addition, more than 52% do not monitor their health. 61.57% do not consume vegetables daily and regular physical activity is not a priority for 66% of them.

In conclusion, the results of this research supports the need for nutrition and health education because a considerable percentage of the population needs to improve their eating habits and lifestyle by consuming nutrient-dense foods, inclusion of physical activity in their daily routine, proper hydration, stress management and health monitoring.

**Keywords:** lifestyle, eating behaviour, balanced diet, successful ageing, physical activity

## CHASING LONGEVITY THROUGH DIET COMBINED WITH PHYSICAL ACTIVITY – A CASE STUDY

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As we age, physiological responses to stressors tend to change and adapt at a different rate, slowing down key functions. Their restoration can be achieved through prevention, improved dietary patterns, the inclusion of physical activity in the daily routine, improvement of sleep quality, normalization of body weight, improvement of lifestyle and reduction of stress factors that can modulate the aging pathway through their action of the triggering factors. The holistic approach, which combines balanced nutrition and lifestyle modification, is the optimal way to have an impact on improving the health status, quality of life and life expectancy of all individuals.

The case study lasted 15 months. The subject was a 23-year-old sedentary woman with morbid obesity, amenorrhea, extensive dieting history, and a chaotic and monotonous diet. Through personalized nutritional interventions and an individual training program, the aims were to normalize weight, reduce the percentage of body fat, acquire an adequate balanced, nutritious and diversified diet, reduce emotional eating, improve medical analyses, increase self-esteem, include physical activity as part of the daily routine, improving the level of energy and sleep, regulating the circadian rhythm. To monitor the entire process were used the following tools: the initial assessment sheet, intermediate assessment sheets, the food diary, the body analyzer that uses the BIA technique, the centimeter and the biochemical analyses. Throughout the 15 months, the subject lost 29.8 kg, changed her body composition by lowering her body fat percentage by 10.4%, regulated her periods, learned to make balanced food choices, adjusted his sleep schedule and included physical activity in the daily routine.

In conclusion, even if the subject has not yet fully achieved his main goal, the lessons she learned and the experiences she has had have helped her to understand that a balanced lifestyle for avoiding chronic diseases and chasing longevity should include a balanced diet that provides all the nutrients the body needs, proper hydration, regular physical activity, rest and a productive mindset.

**Keywords:** longevity, health, diet, physical activity, lifestyle

## ULTRASOUND-ASSISTED FREEZING – THE INFLUENCE ON THE RECRYSTALLIZATION PROCESS AND PHYSICAL PROPERTIES OF MILK ICE CREAM

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Ice cream is one of the most popular items within the worldwide food sector. It can be defined as a complex colloidal system consisting of air bubbles, ice crystals and fat droplets dispersed into the serum phase. To inhibit the undesirable recrystallization process in ice cream, a new method in ice cream production is created. Therefore, ultrasound technology has recently attracted considerable interest in connection with ice cream. Ultrasound during freezing is useful for inducing primary and secondary nucleation. Moreover, ultrasound can improve the convective heat transfer coefficient by the implosion of cavitation bubbles. Consequently, ultrasound during freezing may effectively increase the freezing rate and minimize the size of ice crystals.

The aim of this study was to investigate the effect of ultrasound-assisted immersion freezing with a frequency of 21,5 or 40 kHz and a power of 2,4 kW in the chopped mode, on the course of milk ice cream freezing, in comparison to conventional freezer freezing method. Additionally, the milk ice cream was prepared using stabilizers such as locust bean gum, xanthan gum, and  $\iota$ -carrageenan. Based on the results, it was found that ultrasound-assisted freezing shortened the time of ice cream mix freezing. Moreover, samples of milk ice cream with the addition of stabilizers (the frequency of 21,5 kHz) were characterized by the most homogeneous crystal structure. Due to the fact that the smallest average diameter was noted in comparison to all prepared ice cream samples. After 3 months of storage at  $-18^{\circ}\text{C}$ , the average diameter was at level  $7,8\ \mu\text{m}$ , while for the control sample, it was almost  $14,9\ \mu\text{m}$ . In samples after an ultrasound with the frequency of 40 kHz, no matter the addition of stabilizers which may suggest that sonication with these parameters could replace or limit the addition of these substances. Finally, it may be concluded that ultrasound-assisted freezing is a promising tool in ice cream to prevent the recrystallisation phenomena and enhance the quality of ice cream.

**Keywords:** ultrasound, ice cream, stabilizers, ice crystals

## SUSTAINABLE MEASUREMENT OF COLOR DURING STORAGE OF ICE CREAM WITH *SPIRULINA PLATENSIS*

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The aim of current study was to evaluate the color stability of ice cream samples with added dry *Spirulina platensis* by image processing. The change in color characteristics was monitored during 30 days of storage at -18°C. Surfaces of all ice cream samples are captured with digital camera Canon EOS 2000D in like a daylight conditions without any additional light sources, using embedded flash of the camera and using additional flash module connected to the camera. Images of the examined ice cream samples are processed with iceColor software in order to be extracted representative color for every sample under different lightening conditions. Used software implements three methods for color extraction – scalar defined median color, vector defined median color and average color for pixels that fall in selected area. When the software extract representative color there is one parameter that control the images processing and this is mask size that is an odd number not less than three. For current research all methods for color extraction are applied on examined images using mask sized 5x5, 7x7 and 9x9. By this way for one of four selected control days in storage period and for every ice cream sample, three images are captured (without flash, using embedded flash and using external flash) and for every image nine representative colors are extracted (using described three methods and three different mask sizes for every method). All defined representative colors are compared versus instrumentally measured colors by Minolta chroma meter (CIE  $L^*a^*b^*$  system) using correlation analysis.

The results indicate that the highest correlation coefficient (about 0,99 as absolute value) is calculated for images that are captured using embedded flash but for the other two lightening conditions there are also strong correlation (above 0,7). Based on the experimental results can be supposed that control of color changes during storage period could be performed using images processing for images captured with embedded flash (when precision have to be priority) or without any additional lightening (when reduction of energy consumption is more important than precision of color measurement).

**Keywords:** ice cream, *Spirulina platensis*, pigments, color measurement, image analysis

## PRODUCTION OF BIODEGRADABLE PLASTIC FROM ALGAE

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As one of the major sources of environmental waste and water resources, plastic is rarely destroyed by biological and chemical decomposition and endangers the health of living beings. The production of biodegradable plastics from seaweed can minimize environmental pollution and reduce the costs of removing plastic waste. Algae, by producing high metabolite content, can be converted into some value-added products such as bioplastics, the most notable of which are polylactic acid (PLA), and polyhydroxyalkanoates (PHAs). Due to the presence of sulfate polysaccharides, seaweeds are one of the most important biological resources and one of the most effective raw materials in the production of bioplastics. Microalgae can be an ideal source for the production of bioplastics because they can grow on waste resources and do not compete with food resources. Microalgae can use CO<sub>2</sub> during the photosynthesis process and convert it into by-products through metabolic activities. As a result, the microalgae cell can produce bioplastic polymers by trapping CO<sub>2</sub>. Common microalgae for bioplastic formation are Chlorella and Spirulina species due to their high concentration of polysaccharides. Due to its thick cell walls, chlorella is more resistant to breaking and thermal stability than spirulina, and tests have shown that chlorella produces higher quality bioplastic than spirulina in terms of product quality. Consumer-grade bioplastics may also be made using monomers or polymers produced from algal residues, which solves waste disposal problems. Production of algal bioplastics on a large scale faces challenges such as Algae biomass composition, Polymer selection, Consumer awareness and acceptability, Production technology, Cost, and Varying cultivation requirements. However, bioplastics can be produced using green technologies, but further optimization is needed to improve the production process of microalgae bioplastics in terms of processing time, cost, quality, and application.

**Keywords:** Bioplastic, Algae, Polymer, Chlorella, Spirulina

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## **EFFECT OF PRETREATMENT AND FREEZING PROCESSING ON SEVERAL VEGETABLES' QUALITY INDICATORS**

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Vegetables are rich in essential nutrients, dietary fibers, vitamins and in different micronutrients necessary for a healthy living. However, fresh vegetables are available for short periods of time and highly perishable. Therefore, freezing has become a more and more used technique for vegetable preservation. This study aimed at characterizing several fresh vegetables in different moments, during the processing for freezing preservation. The studied raw materials that were analyzed in this study were green peas, green beans, broccoli, asparagus, oyster mushrooms, *Agaricus bisporus* mushrooms and eggplants. The analysis was performed over the studied vegetables, in their fresh form, after blanching and after freezing/thawing process. The following quality indicators were determined: acidity,  $a_w$ , total polyphenolic content, antioxidant activity and ascorbic acid content (where applied). The results showed that pretreatment and freezing/thawing processes did not significantly affect product quality indicators, maintaining their quality over the testing period.

**Keywords:** pretreatment, freezing processing, vegetables properties

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**IMPACT OF HYDROGEL APPLICATION FOR WATER STRESS  
MANAGEMENT ON BIOCHEMICAL PARAMETERS OF  
*LACTUCA SATIVA***

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Agriculture and food production has known a continuous growth in recent decades. This fact led to excessive usage of intensive production techniques, unsustainable exploitation of soil nutrients and water, which can lead to severe environmental problems. Therefore, much research has been conducted to study the impact of hydrogels on improving and optimizing of agricultural inputs. The aim of this study is to determine the effect of different hydrogel compositions on water availability from soil and their impact on plant biochemical composition. In this regard, lettuce (*Lactuca sativa*) was grown in the presence of new 4 different compositions of hydrogels and under stress conditions and it was compared to ones without hydrogels and in regular irrigation conditions. The plants were periodically harvested and analyzed to determine antioxidant activity, total polyphenolic content and ascorbic acid content. The results showed an increase in antioxidant activity and polyphenolic content during the culture period for the plants subjected to water stress. Conversely, the ascorbic acid content was slightly higher for the regularly watered plants. However, the obtained results showed that the values of the studied parameters at the end of the testing period were not significantly different between the two cultures; therefore, the tested hydrogels present great potential to be used in water mangement in agriculture.

**Keywords:** hydrogels, water stress, biochemical parameters

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## THE OPPORTUNITIES OF THE USE OF CORN FLOUR FOR THE PREPARATION OF BREAD

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Food products prepared from corn flour are considered traditional for Moldova. One of the ways to use corn flour in human alimentation is to add it to bread preparation. In this research, the possibility of preparing bread from mixtures of wheat and corn flour was studied to obtain a new product intended for tourist guesthouses, which promotes local traditions from the southern region of the Republic of Moldova. Six bread samples were obtained from the mixtures of wheat and corn flour. Bread samples were baked on the tray from pieces of dough with a spherical shape and a mass of 100, 200, and 300 g.

The notches were cut on the surface of the dough pieces. The dosage of corn flour in the preparation of the dough was 0, 4.76, 9.09, 13.04, 16.67, and 20.00% of the total flour mass. The analysis of the sensory and physico-chemical properties of the bread samples was carried out.

Corn flour does not contain proteins that form gluten, therefore, the addition of corn flour in the preparation of dough can have a negative influence on the rheological properties of the dough and, respectively, on the quality of the bread, which has been demonstrated by obtained experimental data.

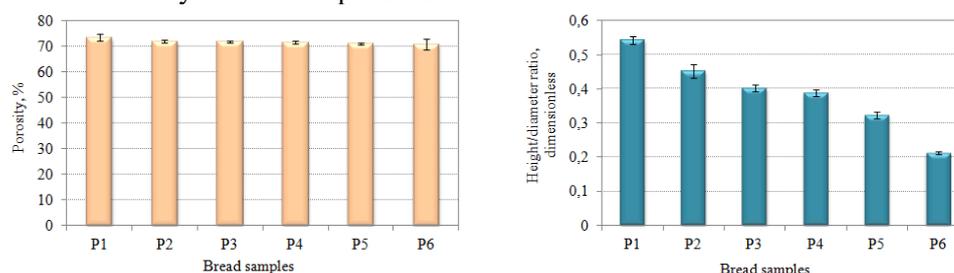


Fig. 1. Porosity and height/diameter ratio of the bread samples prepared from the pieces of dough weighing 300 g without notches

P1 - bread with no added corn flour (control sample); P2...P6 - bread with 4.76, 9.09, 13.04, 16.67, and 20.00% corn flour of the total flour mass

Following the statistical processing of the experimental data, it was found that the increasing addition of corn flour in the preparation of dough had an insignificant influence ( $p = 0.3$ ) on the porosity of the bread core; but a significant difference ( $p = 0.000005$ ) was noted between the values of the height/diameter ratio, which was also observed through visual examination, the bread samples with a higher amount of corn flour being more flattened.

Thus, it is advisable to implement the technology of bread making with the addition of up to 10% of corn flour from pieces of dough weighing 200 g, baked on a tray in a spherical shape with the application of line or cross notches in the agro-tourist guesthouses in the southern region of the Republic of Moldova.

**Keywords:** bread, corn flour, sensory and physico-chemical properties

## INFLUENCE OF BRINE COMPOSITION ON THE QUALITY CHARACTERISTICS OF PICKLED GREEN APPLES (*MALUS DOMESTICA*)

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The pickling process is commonly used in Romania as a method of preserving fruits and vegetables. Among the fruits preserved in this way, green apples (*Malus domestica*) are included. Usually, sodium chloride is used in the pickling brine. Excessive sodium intake is associated with cardiovascular diseases, and over time, alternatives have been sought to reduce sodium consumption. The potassium and magnesium chlorides could be used as sodium chloride substitutes in brine formulation for vegetables pickling.

The main objective of this study was to investigate the influence of brine composition on the fermentation process of green apples (*Malus domestica*) and on the quality of the final product. Three variations of brine combinations were used: potassium and sodium chloride in a 1:1 ratio, potassium and magnesium chloride in a 1:1 ratio and sodium and magnesium chloride in a 1:1 ratio. The study was conducted over a period of 35 days, and the antioxidant activity, physical and microbiological analyses were performed with a frequency of 7 days.

The antioxidant activity was determined using the DPPH assay method. Regarding the antioxidant activity, the highest value (139.43±2.01 mmol TE/g DW) was obtained in the case of the brine variant with potassium and magnesium chlorides.

The color and texture parameters showed variations in all types of brine. The brine with potassium and magnesium chloride in a 1:1 ratio had beneficial effects on the viability of lactic bacteria. The number of the lactic acid bacteria at the end of the fermentation stage varied between 1.9 and 4.2 log CFU for all types of brine.

In conclusion, the brine with potassium and magnesium chloride in a 1:1 ratio positively influences the quality characteristics of pickled green apples (*Malus domestica*) and can reduce sodium chloride in pickled vegetables.

**Keywords:** Green apples, antioxidant activity, pickled, texture, lactic acid bacteria.

## **A STUDY OF POST-HARVEST PROCESSING OF COMMON BEAN – A REVIEW**

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Bean production systems offer unique advantages that support sustainability, including a low carbon footprint and a short growing cycle that facilitate crop diversification and cover crop integration.

The common bean is characterized as a near-perfect food in an impressive number of scientific publications. It is a food considered functional due to its important content in nutrients having a high content of protein, dietary fiber and minerals, being also a rich source of resistant and slowly digestible starch, which causes a lower glycemic response. However, the processing methods can affect more or less the nutritional properties of foods depending on the principle and characteristics of the selected technology.

The purpose of this study was to review some of the processing methods and their influence on the quality of common beans. The most common treatments applied to beans are thermal treatments, at high temperatures (blanching, sterilization, pasteurization) and at low temperatures (freezing, lyophilization) or non-conventional treatments (microwaves, ultrasound, high pressure processing).

The results of this study highlighted the main effects of the identified processing technologies on nutritional and physico-chemical properties of common beans.

**Keywords:** Common beans, processing technology, quality parameters

## **MILLET: A STRATEGIC SOURCE TO DEVELOP NUTRI-CEREAL BASED PRODUCTS FOR MODERN CONSUMERS**

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Millet represents a very good alternative to classical cereals, such as rice, maize and wheat, because of its techno-functional and nutritional properties as well as its health benefits. It has a high concentration of calcium, magnesium, iron, phosphorus, lipid and antioxidant compounds, which can help reduce the risk of cancer, heart disease, and gastrointestinal disorders.

Moreover, millet is a gluten-free grain with different varieties including pearl, finger, kodo, proso, foxtail, little and barnyard millet and it can yield a significant harvest per unit of land, even in drought conditions and nutrient-poor soil. In specialized literature, types of millets are classified as major, minor, other minor and pseudo millets. Considering the compositional and processing advantages of millet, it has become increasingly interesting for the food industry.

The food industry's current focus is on providing the growing global population with quality food to promote better health, which has led to a reconsideration of millet as a raw material. For these reasons, the year 2023 was declared by the United Nations General Assembly as the International Year of Millets.

This work explores, in a critical way, the food products derived from millet highlighting new opportunities to exploit its technological potential either individually or in combination with other grains.

**Keywords:** millet, cereal, sustainable, health-promoting, food

**CONVECTIVE AND INFRARED DRYING OF APPLE CHIPS  
INFUSED IN HIBISCUS EXTRACT TO INCREASE THE  
PHYTOCHEMICAL CONTENT OF APPLE CHIPS SNACK**

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An increasing trend in the consumption of healthier, safe, convenient and easy to preserve food can be noted, due to the increased demand of processed dried convenience foods devoid of synthetic chemical preservatives. In general, the dried foods are considered both safe and shelf stable due to the low water activity, but the major consumers concern is the use of synthetic additives and chemical preservatives to prolong the preservation.

Apples are the fourth most important fruit crop worldwide after citrus, grapes and bananas, considered a major source of polyphenols involved in protection mechanisms against cardiovascular disease, cancer, asthma and diabetes. Despite the dried apple benefits, the color and texture of apple snacks are affected.

The main objectives of this study were evaluating the phytochemical profile of apples chips snack immersed in an aqueous extract of hibiscus calyces, dried using two methods, such as convective air and infrared drying. The chips were dried at 70°C and analyzed for total monomeric anthocyanins, total polyphenols, total flavonoids and antioxidant activity. A significant difference was observed in anthocyanins content in regard with the two drying methods, with 1.72±0.15 mg cyanidin-3-O-glucoside/ g dry weight in case of convective drying when compared with 3.90±0.23 mg cyanidin-3-O-glucoside/ g dry weight for infrared drying. The different content in anthocyanins affected the antioxidant activity, namely the infrared dried apples chips showing a higher value. The results evidence the effect of hibiscus infusion on the phytochemical profile, while color was significant improved.

**Keywords:** apple, convective drying, infrared drying, snacks.

## DEVELOPMENT AND CHARACTERIZATION OF YEAST PROTEIN FILMS

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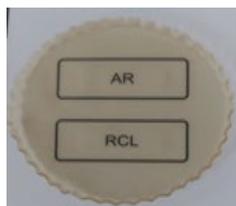
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Innovative alternative solutions to conventional food packaging have been developed in recent years, combining biodegradability with circular economy principles for providing safe food with extended shelf life, while maintaining food quality. Certain new food packaging solutions based on polysaccharides, proteins, lipids or a combination thereof were developed to form either thin independent layers of films (EFs) or pellicles attached to the food surface as continuous coatings ([10.1016/j.lwt.2019.108633](https://doi.org/10.1016/j.lwt.2019.108633)). The effort to find sustainable and economically-feasible alternatives to the current plastic packaging materials used by food industry opened opportunities to look for new unconventional sources of biopolymers materials.

In line with these tendencies, the current study developed edible films based on baker's yeast whole cells. Freeze-dried yeast was used to prepare solutions with 6, 7 and 8% (dw/w) that were further denatured by a combined treatment of sonication for 50 min and thermal crosslinking at  $80 \pm 0.5^\circ\text{C}$  for 35 min; further, glycerol 8.0% (w/w) and Tween 80 8.0% (w/w) were added to improve plasticity and surfactant properties of the films leading to better mechanical properties of the EFs. Film forming solutions were casted, followed by forced convection drying at  $40^\circ\text{C}$  and kept at constant RH (30%) and  $20^\circ\text{C}$  until further testing.

Flexible, resistant, homogenous films (Fig. 1) based on baker's yeast with thickness ranging between 0.13-0.16 mm were obtained and evaluated for their physicochemical and mechanical properties.



**Figure 1.** Edible films based on baker's yeast

Water vapor permeability ranged between  $1.51 \cdot 10^{-7}$ - $6.52 \cdot 10^{-8} \text{ g} \cdot \text{s}^{-1} \cdot \text{m}^{-1} \cdot \text{Pa}^{-1}$  and yeast films exhibited transparency of 65.54- 66.92%. The tensile strength decreased from 3.5 MPa with increasing yeast content from 6% to 8 %, while the strain at break increased with increasing yeast content to about 28.5% for 8% yeast, indicating that the ductility of these films could be improved by the addition of the yeast.

The antimicrobial peptides naturally present in yeast triggered inhibition by films discs tested through diffusion assay against *Rhodotorula glutinis*, *Geotrichum candidum* and *Bacillus cereus*, with diameters of 3.27mm, 10mm and 15mm respectively. Yeast films could thus represent a promising solution for edible packaging of food products.

**Keywords:** yeast proteins; edible films; active packaging; protein denaturation.

**Acknowledgment:** This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS - UEFISCDI, project number PN-III-P1-1.1-TE-2021-0459, within PNCDI III.

## COMPARISON OF THE PROPERTIES OF FERMENTED RED AND YELLOW BEETROOT

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Recently, pickles have become popular. Due to their health-promoting properties, they are part of a well-balanced diet. Salt is essential in the pickling process. However, it is consumed in excessive amounts. Its daily consumption is 9-12 g/day, while it should not exceed 5 g/day. In recent years, it has become important to reduce the addition of salt to food. Studies show that reducing the addition of salt by a few per cent does not significantly change the product's organoleptic properties but can contribute to reducing the consumer's daily salt intake. Therefore, it is important to get an answer to the question of whether we can reduce the salt content of pickles without losing many of their properties.

In this study, was examined how the amount of salt affects the physical, chemical, and microbiological characteristics of fermented vegetables. Red and yellow beet samples prepared in our laboratory as examples were used. Our findings will help determine the ideal salt content for the fermentation process and identify a variety with superior qualities. To conduct the experiment, fermented raw materials with varying salt concentrations ranging from 0 to 6% were prepared. Analyze pH, total acidity, colour changes, betalain pigment content, and the number of lactic acid bacteria present were made.

The results showed that lowering the salt addition preserves the desired properties of the product. Both varieties of beet proved to be good raw materials for fermentation. The yellow variety showed a higher lactic acid content and a higher abundance of LAB bacteria. Salt content had no significant effect on colour changes during fermentation. Reducing the salt content to a maximum of 3% yields a product most rich in probiotic lactic acid bacteria.

Reducing the salt content to a maximum of 3% yields a product rich in probiotic lactic acid bacteria. Lower salt values (from 0 to 3%) can achieve the best physicochemical parameters of fermented beet, reducing salt content in fermented products without compromising quality. This may help in efforts to reduce salt consumption among consumers.

**Keywords:** beetroot, salt, fermentation, lactic acid bacteria, betalains

## EVALUATION OF HAND-MADE PASTA PRODUCTION BY USING SEA FENNEL (*CRITHMUM MARITIMUM* L.)

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Sea fennels (*Crithmum maritimum* L.) which is one of the halophyte plants is traditionally used in many countries as an ingredient for many foods and medicine owing to its attractive sensory attributes and abundance of essential oils. Pasta is preferred by consumers because it is simple to prepared, and it has low cost and long shelf life. Therefore, hand-made pasta was enriched with the sea fennel powder with 5 and 10% substitution ratios in this study. For the evaluation, several experiments were conducted such as, cooking properties, physical analyses, and sensory properties of hand-made pasta samples. The results showed that the lightness and redness of the samples were decreased while substitution of sea fennel ratio is increased from 0 to 10%. On the other hand, yellowness values were increased significantly ( $p<0.05$ ), which was associated with its own color of sea fennels. Similarly, cooking loss and swelling index of the hand-made pasta changed with the substitution ratio. The reason for these changes in the cooking properties could be related to reduction of gluten content and increasing of dietary fiber content in the pasta dough. Besides, the texture result of the sample showed that addition of the powder raised the hardness of the sample because decreasing insoluble material. Besides, the reduction of gluten network resulted in lower absorption was caused to decreasing hardness of the pasta sample. As a result, the combining of pasta flour with the sea fennel powder caused the change in the hand-made paste properties in terms of texture and cooking qualities.

**Keywords:** Halophyte plant, *Crithmum maritimum* L., hand-made pasta, cooking properties.

**DEVELOPMENT OF PEANUT SPREAD CONTAINING  
*ARTHROSPIRA PLATENSIS* VAR. *TOLIARA* AS A READY-TO-USE  
THERAPEUTIC FOOD TO TREAT MALNUTRITION**

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The challenge of improving the food security situation in Madagascar, as in other developing countries, face of the problem of chronic and acute malnutrition, which affect one from five children under five years, requires innovative strategies or a significant optimization of existing strategies. The valorization of resources rich in nutrients and phytochemicals such as Spirulina is one of the solutions adapted to treat and prevent acute and chronic malnutrition. The present research was designed to formulate a functional food: peanut spread “RUTF” from different indigenous sources and Malagasy strain Spirulina (*Arthrospira platensis* var. *Toliara*). The formulations have been meticulously developed through the blending of dried biomass of spirulina, peanuts, sugar, and oil. In-depth studies were carried out on the incorporation rates of spirulina powder and various production parameters in order to characterize and optimize the effects on product quality. The findings indicated that the addition of spirulina to the formulation has a significant effect on the rheological and organoleptic properties. The viscosity of the spread decreases and the color intensifies significantly. From a nutritional point of view, an increase in the amount of spirulina powder proportionally improves the nutritional value of the product. Before delving into studies on the treatment of malnutrition, additional sensory evaluation studies, including descriptive and acceptability tests, could be conducted to further enhance the comprehensiveness of the research.

**Keywords:** *Arthrospira platensis* var. *Toliara*, peanut spread, formulation

## **FOOD SAFETY CHALLENGES IN THE NEAR FUTURE**

## ***SALMONELLA* CHANGES ITS CARBON METABOLISM FOR PERSISTING IN AGRICULTURAL ENVIRONMENTS**

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The human pathogen *Salmonella enterica* is a constant threat to human population. Agricultural environments, such as soil and crop plants, may be alternative ecological niches and vectors for *Salmonella*, increasing the risk for consumers. We investigated therefore mechanisms used by *Salmonella* to adapt to agricultural environments. We focused on metabolism by analyzing the abundance of intermediates in glycolysis and the tricarboxylic acid pathway in specific environments, as well as in bacterial cells. By analyzing transcriptome data of *Salmonella*, several genes seemed important for persistence in roots or leaves. By comparing metabolites and gene expression between wild type and different mutant strains, fumarate accumulation was discovered as important possibility to improve persistence. We postulate that *S. enterica* adapts to agriculture by adjusting its carbon metabolism to the carbon sources available in particular environment. These understandings may help in the development of future strategies aiming at lowering *Salmonella* contaminations.

**Keywords:** *Salmonella*, carbon metabolism, diluvial sand soil, lettuce, tomato

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## THE INFLUENCE OF *SEA BUCKTHORN* PUREE ON THE OXIDATION PROCESS OF LIPIDS IN MAYONNAISE

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Foods high in fat are prone to lipid oxidation. Mayonnaise is also rich in vegetable oil and is classified as a cold sauce in food technology. Antioxidants are the most effective lipid oxidation inhibitors, which can maintain product freshness and to prevent its discoloration or rancidity. Texture, colour and odour changes are negative effects of the lipid oxidation process.

To improve the quality of the mayonnaise, it has been proposed to add sea buckthorn puree to the mayonnaise formulations, as it is rich in antioxidants as carotenoids that have a positive impact on the final product.

In the presented work, samples of mayonnaise with partial replacement of vinegar by sea buckthorn puree in concentrations of: 3%, 5%, 7% were investigated during storage. During 28-day storage of mayonnaise samples with added sea buckthorn puree, the physicochemical characteristics showed improved results in comparison with control sample of traditional formulation.

Titrate acidity values decreased from 0.13% in the control sample to 0.09% in the 7%-sea buckthorn sample. This tendency is also observed during storage in all samples in correlation with the concentration of sea buckthorn puree. The pH values of the sample with 5% addition of sea buckthorn puree showed constant values, with a non-significant decrease from 5.04 to 4.89 on days 21 and 28. This result demonstrates a good stability of the fat emulsion in the mayonnaise composition. The peroxide values were within the permissible limits of the regulations. The most relevant results showed the samples with 5% and 7%: respectively, 1.993  $\mu\text{mol}$  active oxygen/kg and 1.738  $\mu\text{mol}$  active oxygen/kg. These results shows that the higher concentration of sea buckthorn in the sample corresponds with the slower peroxide value increases during storage. The sample with the addition of 5% sea buckthorn puree showed good results in preventing oxidation of lipids in mayonnaise and appreciable sensorial properties.

**Keywords:** oxidation, sea buckthorn puree, mayonnaise, quality

**Acknowledgment:** The research was supported by the State Project of the Republic of Moldova 20.80009.5107.13 "Development of technology for production of sea buckthorn in ecological system and processing of fruit and biomass".

## PHYSICO-CHEMICAL AND SENSORY ANALYSIS OF BANANA FLOUR

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The work includes the characterization of Musa species bananas. They were found to be the 2nd most consumed fruit in the world. Green bananas were specifically chosen because they are more effective in increasing the metabolic rate and burning fat. Compared to ripe bananas, green bananas contain less sugar. They can be eaten raw, cooked or in the form of flour, as a food alternative for people suffering from gluten intolerance. The flour was obtained by drying green bananas in a dehydrator at a temperature of 60 °C for 6-10 hours. Then it was analyzed physico-chemically by determining the content of polyphenols (80,16 g/100 g), titratable acidity (0,18 °), moisture (9,5%), ash (3,4 %) and pH- flour flour (4,9). Green banana flour was found to have a significant carbohydrate content (70,84 g/100g); dietary fiber (8,5 g/100 g); proteins (4,3 g/100 g) and lipids (0,33 g/100 g). The energy value of 100 g of flour was calculated, which is 333 kcal. It has been established that green banana flour is rich in vitamins: vitamin C (22 mg/100 g), vitamin B3 (1,8 mg/100 g), vitamin B6 (0,9 g/100 g), vitamin E (0,3 mg/100 g), vitamin B2 (0,21 mg/100 g), vitamin B1 (0,1 mg/100 g), vitamin B9 (70 µg/100 g) and vitamin A (9 µg/100 g). The content of mineral elements in banana flour is very important and is represented by: K (927 mg/100 g), Mg (70 mg/100 g), P (66 mg/100 g), Ca (15 mg /100 g), Na (3 mg/100 g), Fe (0,74 mg/100 g), Zn (0,21 mg/100 g), Cu (0,22 mg/100 g), Mn (0,33 mg/100 g). All determinations obtained had very favorable results, which were included in the universal standards for green banana flour. The banana flour was also analyzed organoleptically, it had a very fine texture, a pleasant smell and did not have any impurities, it was pleasant both sensory, gustatory and olfactory.

**Keywords:** nutritional and energy value, carbohydrates, dietary fiber, polyphenols, vitamins

**ANTAGONISTIC AND DETOXIFICATION POTENTIALS OF  
*TRICHODERMA* ISOLATES FOR CONTROL OF T-2 TOXIN  
BIOSYNTHESIZING *FUSARIUM SPOROTRICHIOIDES***

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Trichoderma fungi are promising candidates for grain plant biocontrol due to their antagonistic properties, as well as their potential to degrade food contaminants. Management of toxic fungi by Trichoderma is considered a sustainable and environmentally friendly strategy for controlling cereal plant pathogens. This study aimed to evaluate the competitive ability of selected Trichoderma species and fungal strains against *F. sporotrichioides* and understand the mechanisms underlying antagonism. We also evaluated the ability of Trichoderma strains to inhibit T-2 toxin biosynthesis and their potential for toxin biotransformation. Using in vitro tests on PDA medium and rice grains, it was shown that Trichoderma fungi are capable of exhibiting antagonistic properties against other pathogenic fungi and inhibiting the biosynthesis of mycotoxins produced by Fusarium. In addition, the possibility of biotransformation of mycotoxins was observed using the T-2 toxin as an example. The results obtained from metabolomic analysis provide valuable insight into the complex interactions between Trichoderma fungi and Fusarium pathogens and may contribute to the understanding of the mechanisms underlying biocontrol.

**Keywords:** *Trichoderma*, T-2 toxin, biotransformation, mycotoxins, food safety

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**EFFECT OF THE DRYING PROCESS ON THE STABILITY  
AND PROFILE OF CANNABINOIDS AND TERPENES FOUND IN  
CANNABIS SATIVA L. VAR. SATIVA**

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Regarding the growing market for products containing dried hemp or extracts derived from it, it is necessary to carry out optimization of drying methods for the plant elements to obtain the highest quality product. Knowing the level of degradation of individual compounds found in *Cannabis sativa* L. var. *sativa* will allow the maximum content of the substances in question to be ensured and the possibility of using dried hemp in the food industry to be determined. This study aimed to determine the effect of the drying method of selected elements of the *Cannabis sativa* L. var. *sativa* plant (inflorescences, leaves) on the stability and profile of cannabinoids and terpenes. Three drying methods were compared: freeze-drying, traditional drying (room temperature about 23°C, 10 days), and convection drying (50°C, 60°C and 70°C for 24h). Cannabinoid content was analyzed using liquid chromatography–Q-Exactive Orbitrap mass spectrometry operating with a heated electrospray interface (UPLC-HESI-MS), and terpene content was assessed using gas chromatography coupled to a mass spectrometer (GC-MS). Based on the results, the drying method (including temperature and time) was found to have a significant effect ( $p < 0.05$ ) on the profile of cannabinoids and terpenes in selected plant parts. The degradation of acidic cannabinoids to a neutral form was observed as a result of drying by the selected methods. Freeze drying had the least significant effect ( $p < 0.05$ ) on the terpene profile. This process also had the least significant effect on the degradation of acidic cannabinoids. Based on the results, it was concluded that carrying out optimization of drying methods is essential to ensure food safety.

**Keywords:** thermal processing and stability, cannabinoids, hemp

**DIELECTRIC BARRIER DISCHARGE COLD PLASMA  
TREATMENT OF SOY PROTEIN ISOLATE AND PEA PROTEIN  
ISOLATE: INSIGHTS INTO THE PHYSICOCHEMICAL AND  
FUNCTIONAL CHARACTERISTICS**

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There has recently been an abundance of research with the goal of determining how cold plasma (CP) alters plant proteins. Pea protein isolate (PPI) and Soy protein isolate (SPI) were subjected to a CP treatment using a Dielectric barrier discharge (DBD). The physicochemical, structural, and functional characteristics of the isolates were enhanced with treatment at 30, 35, and 40 kV for 2, 4, and 6 minutes. Particle size, color, solubility index, oil holding capacity (OHC), water holding capacity (WHC), and emulsifying attributes were all significantly affected by CP. With an increase in voltage and time, WHC for SPI and PPI reached 25% and 35%, respectively. The OHC pattern was consistent for both the samples. The particle size of the CP-treated samples increased, with PPI showing the greatest increase compared to SPI. The b\* value of the protein isolates increased when treatment duration and applied voltage increased, as revealed by the color analysis. Solubility of both the isolates were almost around 18-20 % after CP treatment compared to the control (10 %). In addition, circular dichroism (CD) spectroscopy was used to look at the secondary structure. Analysis by CD demonstrated that plasma reactive species generated changes in secondary structure. Increasing voltage and time resulted in a diminishing amount of  $\alpha$ -helix, whereas varying amounts of  $\beta$ -strands and  $\beta$ -turns were produced.

**Keywords:** cold plasma, soy protein isolate, Pea protein isolate, physicochemical properties

**Acknowledgment:** The authors would like to thank Department of Agricultural and Food Engineering, IIT Kharagpur for providing the facilities and the required instruments.

## **EFFECT OF PECTIN EXTRACTED FROM APPLE POMACE ON THE QUALITY AND BIOLOGICAL VALUE OF FRUIT BARS**

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Apple pomace is an agro-industrial byproduct, being an important source of functional compounds, such as carbohydrates, dietary fibers, phenolic compounds, vitamins, minerals and others. Pectin derived from apple pomace is used in pharmaceutical, food technology, cosmetic and other industries, where it serves as biopolymers, preservatives, antioxidants, anticorrosive and protective agents for various surfaces. The aim of the research was to evaluate the effect of crude pectin extracted from apple pomace used as a binding and coating agent in the manufacture of fruit bars on their quality and biological value during 12-month storage. The fruit bars were prepared from chopped dried fruits (apples, cherries, plums and rosehip powder) and apple pectin solution, which was used as a binding and coating agent. Pectin obtained from Golden Delicious apple fruits was obtained by microwave extraction. The gloss fruit bars were packed in PA/PE (polyamide-polyethylene) vacuum bags and stored in the dark at room temperature for 360 days. The evaluation of the sensory characteristics, physicochemical indicators, microbiological stability, and biological value of the fruit bars was carried out every 3 months for a period of 12 months. The results show that the use of pectin positively influenced the external appearance, consistency, color, and flavor of the fruit bars. The comparison of the physicochemical indicators of the fruit bars, determined in the first and last storage days, showed that they correspond to the normative documents in force. At 360 days of storage, moisture loss was 21.3%, titratable acidity decreased by 0.29%, water activity decreased by 14%, and pH increased by 0.34 units. From a microbiological point of view, the reduction of moisture content and water activity, as well as the presence of the pectin protective layer and vacuum packaging stopped the development of microorganisms during storage. Pectin was also shown to have a stabilizing effect, helping to minimize the degradation process of bioactive compounds during storage. Thus, after one year of storage, the total content of polyphenols and flavonoids in the fruit bars decreased by 27.2% and 32.7%, respectively, and the DPPH antioxidant activity decreased by 19.0%. It was concluded that crude pectin, used in the formulation of fruit bars as a binder and coating agent, demonstrated the protective effect of the functional value of fruit bars stored for 12 months.

**Keywords:** apple pectin, dried fruits, biopolymer coating, fruit bars, biological value, quality.

**Acknowledgment:** The research was funded by State Project no. 2080009510709 "Improving of food quality and safety through biotechnology and food engineering", running at Technical University of Moldova.

## MATHEMATICAL ANALYSIS OF DEEP FRYING OF FRENCH FRIES

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In this research, a potato sample of which size is determined, deep-fried in sunflower oil, moisture loss and oil absorption during the frying process were analyzed with mathematical models.

For frying, french fries (1.2\*1.2\*4 cm), sunflower oil in tin can and a domestic fryer were used. 3 different temperature parameters (160 °C, 170 °C, 180 °C) and 5 different time parameters (180 s, 240 s, 300 s, 360 s, 420 s) were studied. Two of the temperature probes were placed horizontally and vertically on the potato, and the other probe was immersed in oil to control the oil temperature. The frying process with probes was carried out with temperature control. Samples were taken from potatoes fried at different temperatures and times, weight differences, oil analyzes and moisture analyzes were performed before and after. Soxhlet method was used for oil analysis and oven-drying method was used for moisture analysis. As a mathematical model, as Pedreschi and Zuniga defined in a study, deep fat frying has been defined as a kind of drying process. First,  $M_r$  was calculated, and  $k$  was calculated using Fick's second Diffusion law and Newton's semi-empirical model.

Then, for each temperature parameter,  $De_{eff}$ , followed by  $E_a$  of the whole frying process was calculated with the help of  $k$ . The same equations are calculated for the oil transfer to the potato at 170 °C, which is taken as the maximum oil transition temperature. As predicted, as the frying time increased, a decrease in  $M_r$ , a decrease in the  $k$ , and an increase in the  $De_{eff}$  were observed. Differences were observed in the  $De_{eff}$  value compared to other studies in the literature, and this difference was considered reasonable considering the potato sizes and shape differences.

With this study, it is aimed to contribute to literature by analyzing the moisture transfer from potato to oil and oil transfer from oil to potato during a real frying process for the consumer.

**Keywords:** French fries, deep-frying, mathematical modelling, oil absorption

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## SPECIATION OF ARSENIC NEUTRALISED FROM FOOD BY *PLEUROTUS OSTREATUS*

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Mycoremediation is a process carried out by fungi during which, thanks to a specific antioxidant system, they accumulate and accumulate toxic agents in their structure. This issue is important for modern man due to the global problem of environmental pollution by heavy metals, which in the countries of the European Union is controlled through Commission Regulation (EU) No 2023/915. This provides a rationale for determining the possibility of using fungi in the process of food detoxification.

The aim of the study was to investigate the ability of fungi of the genus *Pleurotus* to neutralise arsenic contamination of the substrate. The study was conducted on fungi of the genus *Pleurotus ostreatus* grown on a sawdust/rice mixture contaminated with 250 µg As/ kg of substrate. The lyophilised test material was subjected to quantitative analysis by inductively excited plasma mass spectrometry, followed by speciation by HPLC-ICP/MS.

The results obtained confirmed the strong absorption capacities of the heavy metals. The main site of arsenic accumulation appeared to be the stems, where the amount of the element exceeded 100 µg/ kg wet weight in some cases. Furthermore, fungal growth on the substrate resulted in intensive arsenic metabolism, which was evident in the substrate after fungal growth in the form of reduced concentrations of inorganic forms at the expense of MMA. In the stems themselves, however, arsenobetaine accumulation was observed at a concentration of 23.8 g/kg fresh weight and MMA.

The accumulation of arsenic in the fungi and the reduction of the most toxic forms of the element in the substrate indicate the potential possibility of using oyster mushrooms, or other fungi, to neutralise environmental contamination, including food, with heavy metals using biological methods.

**Keywords:** arsenic, fungi, neutralisation, *Pleurotus*, contamination

## OCCURRENCE OF MICROPLASTICS IN FOODS AND HEALTH EFFECTS

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As lightweight and wear-resistant products, plastics are commonly used in various industries and products, but if they are not appropriately managed both while in use and after the completion of their life cycle, they are in danger of eventually becoming waste like other microplastics. Microplastics are pieces of plastic with an aerodynamic diameter of less than 5 mm. Since the first discovery of ubiquitous microplastics in the environment in 1974, many studies have shown that microplastics are found in bivalves, fish and shrimps living in oceans and seas, as well as in soil, birds, various land creatures and the atmosphere, especially in recent years in land plants. Furthermore, microplastics in the drinks come from the source of water, from the air, from the production processes and from long-term storage in packaging. Humans are also exposed to microplastics by consuming contaminated food. PA, PE, PES, PET, and PP are the most detected polymer types in various food studies. Characteristics of microplastics such as color, polymer type, shape and size are also important. Based on the average amount of microplastics in foods according to FAO and WHO, the estimated "maximum" estimated annual intake of microplastics from these foods for the general population is  $1.42 \cdot 10^5$ - $1.54 \cdot 10^5$  particles/person, equivalent to about 50 plastic bags. Studies have shown that microplastics are toxic to biota and cells. Exposure to microplastics can trigger inflammation, oxidative stress, toxicity to the nervous and reproductive systems, and alter the structure of the intestinal flora in the biota. Therefore, more research and studies should be conducted on the impact of these microplastics on humans and other living organisms, and their use should be monitored and regulated. In this study, microplastics, which are becoming more and more important today, their types, their presence in foods and their health effects were evaluated in detail.

**Keywords:** biota, microplastics, microplastics in beverages, microplastics in food

**AS A CEREAL SUBSTITUTE AMARANT SEED (AMARANT SPP.)  
AND ITS EFFECT ON THE PHYSICOCHEMICAL AND  
TEXTURAL PROPERTIES OF BREAD**

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Cereals have been one of the major sources of nutrition since the first ages of humanity. But, estimating the production and consumption quantities of all grains (wheat, rice, barley, corn) worldwide in the past 5 years shows that the increase in production volume is significantly lower compared to the consumption ratio. Therefore, it is clear there will be an increase in global demand for carbohydrates in the long term, and there will be a need for alternative sources instead. Pseudocereals have gained popularity with the exchange of food expectation. Studies have shown that amaranth seeds can be used in the food industry in bakery products, salad dressings, and dairy beverages.

It is believed that it can be used in the production formula to reduce gluten content and increase protein content in bread making. Additionally, due to its characteristic structure, its use in bread increases the overall fiber content and serves as a regulator for individuals with health issues and those following a functional diet, and it is considered as a new substitute for carbohydrate support. In this study, it is aimed to examine the effects of formulations created with the addition of amaranth seeds in different ratios on their physicochemical content and textural properties by comparing them both with each other and with the control group (without amaranth).

For this purpose, in addition to moisture and yield calculations, color and texture analyzes which shows basic physical quality in breads. The low moisture content of amaranth flour had been reducing effect of the bread moisture. In connection with this situation, the hardness values of the products also increased. It was observed that breads generally have a darker and more saturated color with increasing use of amaranth flour mainly due to the naturally pigments in amaranth flour. The results of the study show that amaranth flour has the potential to be used as a new carbohydrate source. It is thought that amaranth flour can be used to gain functional properties to bread with the use of support components such as additives and enzymes with the further analyses.

**Keywords:** amaranth seed, alternative cereals, bread, functional food.

## INCREASING THE GROWTH RATE AND PERFORMANCE OF RAINBOW TROUT BY REPLACING MEALWORM IN THEIR DIET

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Food production of animal origin shows rapid growth worldwide due to increasing human demand. The aquaculture sector is one of the main players in terms of the volume of animal protein production, and the availability of feed to supply the aquaculture feed chain will be one of the main challenges in the coming decades. Recently, many studies have been focused on alternative protein sources, in this regard, it seems that the use of insects in feeding aquatic animals can be a suitable alternative. After replacing mealworm larvae powder *Tenebrio molitor* in the feed of rainbow trout with a weight of 20 grams and analyzing the data after 60 days of the rearing period, the best effective amount of mealworm larvae powder on the growth and performance of fish was determined. The results of the growth factors of rainbow trout that were subjected to different treatments showed that after the rearing period, the fish that were fed with a diet of 30% Mealworm powder (TM30 treatment) had the highest growth and weight gain and final weight. In other growth factors such as final length, average daily growth, specific growth rate, obesity coefficient and survival, there was a significant difference between the treatments.

**Keywords:** food safety, challenges, *Tenebrio molitor*, diet

## COMPOSITE PACKAGING FILMS BASED ON WHEY PROTEINS FUNCTIONALIZED WITH THYME ESSENTIAL OIL AND POLYLACTIC ACID

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Biodegradable bio-based packaging materials obtained from industrial by-products, functionalized with active essential oils (EOs) represent a good solution for food packaging using environmentally-friendly materials. Whey films (WF) with EOs, can be easily covered by other layers and converted into structures with better mechanical and permeability properties compared with WF. The poly lactic acid (PLA) fibers produced by electrospinning provide a protective coating matrix to whey films functionalized with EO's.

The aim of this study is to characterize one side active films from whey proteins functionalized with Thyme EO (TEO) with different density layers of fibers resulted from PLA, on one side of the film, obtained at different electrospinning durations. The films of WF/TEO with PLA fibers obtained by electrospinning at different electrospinning times (90, 150, 210 min) using one pump and 210 min or two pumps, were coded: WF/G1, WF/G2, WF/G3 and WF/G4 respectively.

The films obtained displayed good optical properties, a moderate permeability to water vapors and gases, and improved mechanical resistance due to the fibrous network of PLA applied on one side of the film. Tests showed that the volatile terpenes contained by TEO have antimicrobial activity against *Listeria monocytogenes*, while the films with embedded TEO (3%) are able to inhibit the growth of the pathogen. Active packaging with TEO display antimicrobial effect against *Bacillus cereus*, *Geotrichum candidum* and *Rhodotorula glutinis*. This structure showed good prospects to be applied as packaging material for cheese and an alternative to conventional packaging.

**Keywords:** films; thyme essential oil; nanofibers; electrospinning; whey protein, polylactic acid.

**BIOACTIVE COMPOUNDS' PROFILE AND ANTIBACTERIAL ACTIVITY COMPARISON BETWEEN NEEDLE LEAVES OF *JUNIPERUS COMMUNIS* AND *JUNIPERUS OXYCEDRUS***

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The purpose of this paper is to present a comparison between the needle leaves of *Juniper communis* and *Juniper oxycedrus*, based on their bioactive compounds' profile and antibacterial activity. The wild samples were collected in Albania (*J. communis* in Mat, and *J. oxycedrus* in Has) between December 2022 - January 2023. The dried needle leaves were extracted with two solvents, ethanol 70% (w/w) and a mixture of *n*-hexane and acetone (3:1 w/w), using ultrasound assisted extraction.

The carotenoid and phenolic profiles of the samples were obtained by chromatographic methods. The antibacterial activity was tested using disk diffusion method on *Bacillus spp.*, *Escherichia coli* ATCC 25922, and *Staphylococcus aureus* ATCC 25923. The HPLC results from the carotenoids' profile showed that the major compound was  $\beta$ -cryptoxanthin with an average of  $364.28 \pm 4.73$   $\mu\text{g/g}$  extract in *J. oxycedrus*, and  $91.42 \pm 2.15$   $\mu\text{g/g}$  extract in *J. communis*.

From the phenolic compounds' profile of the ethanolic extracts, the major bioactive compound identified in the extract of *J. oxycedrus* needle leaves was (-) – epigallocatechin with a concentration of  $1129.23 \pm 3.66$   $\mu\text{g/g}$  extract. The extract of *J. communis* showed a high amount of ellagic acid ( $8133.83 \pm 4.03$   $\mu\text{g/g}$  extract) and kaempferol ( $179.86 \pm 2.26$   $\mu\text{g/g}$  extract). The antibacterial properties of the ethanolic extracts showed positive results for both varieties of juniper needle leaves. *J. communis* had a stronger effect on *E. coli* with an inhibition zone of  $14.50 \pm 0.50$  mm, followed by *Bacillus spp.* with an average of  $12.00 \pm 1.00$  mm inhibition zone. Meanwhile, the extract of *J. oxycedrus* showed higher antibacterial activity on *S. aureus* with a  $10.00 \pm 0.00$  mm inhibition zone.

Based on the HPLC results, *J. communis* showed a wide phenolic profile with a total of 15 identified compounds. In both samples only 3 carotenoids were identified, however, *J. oxycedrus* had a higher total carotenoids concentration of  $480.49 \pm 16.89$   $\mu\text{g/g}$  extract. The extracts showed remarkable antibacterial activity against the tested pathogenic strains, suggesting that can be used as an innovative ingredient in food products to ensure food safety against some impactful pathogens.

**Keywords:** *J. communis*, *J. oxycedrus*, HPLC, antibacterial, disk diffusion method

**EXPERIMENTAL RESEARCH ON ACTIVE PACKAGING  
APPLICATION ON FRESH CHICKEN MEAT**

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Spoilage of meat represents a great concern during all steps of food chain, from processing to the end consumer. This aspect has an important negative impact on meat industry from an economic point of view. The main reason for meat spoilage is represented by microorganisms' growth. Therefore, many studies have investigated active packaging as a replacement for conventional packaging, due to the its ability of carrying different ingredients with specific properties, such as antioxidant and antimicrobial ones. The aim of this study was to investigate the effect of the application of an active packaging film (based on PLA/PHBV and nanoemulsion containing nisin and dill essential oil) on fresh chicken meat quality. In this respect, several physical-chemical and microbiological analysis were assessed and the results showed an increased shelf life for the samples packed in the presence of the active packaging film.

**Keywords:** active packaging, fresh chicken meat, nisin, dill essential oil

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## NEW INSIGHTS IN CONSUMERS PERCEPTIONS ON ALTERNATIVE PROTEIN SOURCES

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Our daily food choices have a huge impact on the environment. Environmental impact and concerns about maintaining a healthy lifestyle are important factors in consumers' decision to adopt alternative sources of protein. One option for a more sustainable diet is replacing meat with alternative proteins. Consumers can include various sources of protein in their diet, for example replacing meat with a meat substitute or using alternative proteins such as seaweed, beans and so on. Greenpeace has elaborated a new analysis of meat consumption in the European Union, concluding that it should decrease by 71% by 2030 and by 81% by 2050, in order to address the contribution of agriculture to climate change. This would mean an average of no more than 460 grams of all types of meat per person per week leaving the slaughterhouse by 2030 and 300 grams in 2050, down from the current European Union average of 1.58 kilograms / person / week. The objectives of the study were to investigate consumer attitudes towards alternative protein sources, analyze the types of alternative proteins available and identify potential obstacles and growth opportunities in this sector.

A quantitative study based on a questionnaire was employed to identify consumer attitude and perceptions on the consumption of protein from alternative sources and the population's awareness of the impact of meat overconsumption.

The analysis of the data obtained from this study revealed an increase in consumer interest in alternative protein sources and a favorable attitude towards them, due to environmental and health concerns. However, there are different needs and preferences among consumers, indicating the need for further information and continuous development of alternative products to meet consumer demands.

**Keywords:** alternative protein sources, consumers perceptions, questionnaire, on-line survey.

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**RETIRE/RECALL REQUIREMENT IN FOOD SAFETY  
MANAGEMENT SYSTEM OPERATION: CASE STUDY FOR  
BAKERY YEAST**

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Baker's yeast is an important product of the food industry, which can be the subject of a product retire/recall process that can significantly influence the maintenance of consumer confidence, protect the brand image and improve the safety of the food chain. For these reasons, in this paper, we have addressed the retire/recall requirement, as a case study, for baker's yeast, with implications for the optimal functioning of the food safety management system. Legal regulations, nationally and internationally applicable food safety management standards set out the requirements for notification of retire/recall of non-conforming/potentially non-conforming food products. The retire/recall of food products are voluntary actions taken by manufacturers or traders to ensure the food safety of products intended for consumers and, although they often involve high costs in the long term, these decisions prove to be inspiring for the business. With the written notification of the National Food Safety Agency and the National Authority for Consumer Protection, the retire/recall of food products can be ordered by the food operator. The food operator has the obligation to document, implement, maintain functional and update the retire/recall procedure in accordance with the provisions of the applicable food safety legislation and management standards. In addition to protecting affected or potentially affected consumers, these actions have the role of limiting, not only the pecuniary liability for food products with a risk/potential risk regarding food safety, but also the negative impact on consumers and the loss of credibility in the food products offered by a certain producer or trader. The monitoring of food safety compliance of the products on the Romanian Market implies, in addition to following the alignment with the applicable legal obligations, also a permanent supervision of the potential food risks that the use of the food product under normal conditions can bring to the consumer. In practice, there are situations where the food operator has delivered the products to other operators, in this situation each operator in the food chain has the obligation to apply its own retire/recall procedure and to notify the National Food Safety Agency. In conclusion, food chain operators have the responsibility to cooperate in order to ensure the retire/recall from the market of food products that are not safe for the health of consumers.

**Keywords:** retire, recall, notification, food safety, baker's yeast

## VALORIZATION OF BLUEBERRY POMACE AS FUNCTIONAL INGREDIENT AT YOGHURT MANUFACTURING

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After blueberry juice manufacturing, about 20% of the fruits remain as pomace, which is still rich valuable components like vitamins, minerals, functional compounds, fibers.

The main objective of this study was to investigate the possibility to reevaluate the blueberry pomace adding it into yoghurt. To achieve this objective, blueberry pomace was dried in an infrared radiations oven, grinded and added into yoghurt, after fermentation, in three variants of concentration (1, 2, 3%). Physico-chemical (dry matter, pH, acidity, syneresis, color, texture), phytochemical (total polyphenols and total flavonoids) and sensorial analyses were done immediately after manufacturing and after 3 and 7 days of cold storage.

Dry matter and color of the samples was influenced by the quantity of added powder but did not vary significantly during storage. Immediately after manufacturing acidity varied between 82°T (for control sample) and 102°T (for sample with 3% added powder), while at the end of storage an increase with about 8...13% was observed. The most accentuated acidity raise was noticed for the samples with 3% added powder, indicating a potential favorable effect on lactic bacteria development.

Initially, syneresis varied between 28,52% (for control) and 36,62% (for the sample with 3% powder) but at the final stage of storage a decrease in syneresis was noticed. This was correlated with the evolution of samples firmness and cohesiveness, which increased with about 10...60%. These behaviors are owned to the presence of fibers which enhance the texture of the samples.

The phytochemical compounds concentration was correlated with the quantity of added powder, while the sensorial analysis revealed that the sample with 2% added powder was the most acceptable.

The conclusion of the study is that blueberry pomace could be used as functional ingredient at yoghurt manufacturing but further studies regarding addition optimization are required.

**Keywords:** blueberry pomace, yoghurt, functional compounds

## FUNCTIONALIZED ZEIN EDIBLE COATING FOR HAZELNUTS SHELF-LIFE EXTENSION

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Edible packaging is an environmentally sustainable strategy for shelf- life extension of food products. Edible coatings (EC) are thin layers of edible material directly applied to the surface of the food product, obtained from a solution based on edible, biodegradable, easily renewable polysaccharides, proteins, lipids or a mix of the above, placed as a barrier between the food and the surrounding environment. To broaden their area of application, ECs can be functionalized with diverse active substances bearing antioxidant and/or antimicrobial activity or with probiotics.

Application of EC followed by low-temperature storage prolongs food storability, as it can provide a selective barrier to water vapors, oxygen, carbon dioxide, and volatiles, as well as a defense against mechanical disruption of the outer layer of the coated food product without altering the taste and texture of the food.

This study evaluated the efficacy of zein-based coating (ZEC) formula containing laurel (*Laurus nobilis*) essential oil as active compound, applied to roasted hazelnuts for extending their shelf-life. The alcoholic solution of zein was thermally denaturated at  $70 \pm 0.5^\circ\text{C}$  for 30 min., mixed with glycerol and laurel essential oil, then applied by dip coating to hazelnuts and air drying at room temperature ( $25^\circ\text{C}$ ) (Figure 1). The protective effect of ZEC was evaluated during accelerated shelf-life testing performed at  $50 \pm 0.5^\circ\text{C}$  for 30 days.



**Figure 1.** Zein coated hazelnuts, functionalized with laurel essential oil

Oxidative stability of zein coated hazelnuts was assessed by peroxide and thiobarbituric acid values, assays performed weekly during one month of accelerated storage. Laurel essential oil exhibited good antimicrobial effect against *Geotrichum candidum*, *Rhodotorula glutinis* and *Bacillus cereus*, which are part of common hazelnut's microbiota. Volatile fingerprint of coated hazelnuts was determined by gas chromatography, which indicated cinelole and terpineol as the most abundant compounds present in laurel essential oil, responsible for oxygen scavenging effect, thus retarding the oxidative rancidity processes.

Laurel functionalized ZEC applied to hazelnuts had a good sensorial acceptability and proved to be an effective packaging in retarding oxidative rancidity processes.

**Keywords:** zein, edible coating, hazelnuts, oxidative rancidity, accelerated shelf-life testing.

**PROTEOMICS STUDIES ON *LISTERIA MONOCYTOGENES* EGDe  
Δlmo2229 STRAIN AFTER SALT STRESS CONDITIONS  
EXPOSURE**

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*Listeria monocytogenes* is one of the foodborne pathogens that has a high resistance to NaCl concentrations. This study aimed to investigate by proteomic analysis the proteins profile of *Listeria monocytogenes* EGDe Δlmo2229 strain compared to its unmodified counterpart after exposure to the salt stress. A concentration of 2x10<sup>5</sup> CFU/mL of *Listeria monocytogenes* EGDe (un)modified strains was growth at 37°C for 24 hours in medium supplemented with 3% and 6% NaCl, respectively.

Following bacterial cell lysis and SDS-PAGE gel electrophoresis, the proteins were subjected to in-gel digestion (IGD) using trypsin. Subsequently, the digested peptides were concentrated and purified using ZipTip C<sub>18</sub>. The peptides analysis was then performed by LC-ESI-MS/MS analysis.

The results obtained emphasized that a number of ten different proteins were expressed in the *Listeria monocytogenes* EGDe Δlmo2229 strain grown in medium with 3% NaCl compared to its control and just five proteins were identified when the growth was made in the medium with 6% NaCl. However, it is worth noting that the identification of some proteins was limited by their absence in the UniProt database. This observation highlights the challenges in characterizing the entire proteome of *Listeria monocytogenes*, indicating the need for further research and comprehensive databases to encompass the full range of *Listeria monocytogenes* proteins.

The presence of hypothetical proteins underscores the complex and dynamic nature of *Listeria's* stress response mechanisms. Future investigations should focus on elucidating the functions and roles of these unidentified proteins and exploring additional factors that contribute to *Listeria's* high resistance to NaCl concentrations.

**Keywords:** proteins' transcription, *Listeria monocytogenes* EGDe, lmo2229, osmotic stress, food safety

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## **BIOTECHNOLOGY FOR A SUSTAINABLE FOOD PRODUCTION**

**THE EXISTENCE OF A NOVEL PHASE VARIATION  
MECHANISM OF EGGERTHELLA LENTA POTENTIALLY  
AFFECTING SUSCEPTIBILITY TO PHAGE INFECTION**

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The human gastrointestinal tract hosts a wide variety of microorganisms (bacteria, archaea, yeasts, protists and viruses), with the number of bacteria residing in the human gut estimated to be  $10^{11}$  CFU/g of faeces. These bacteria are understood to play an essential role in the metabolism of nutrients and xenobiotics. *Eggerthella lenta* has been found in 81.6% of tested individuals and is implicated in the metabolism of a vast array of substances, both medicinal and dietary. Bacteriophages (phages) are viruses that specifically infect bacteria. Their numbers are estimated to be equal to or less than that of their bacterial hosts in the human gut and are understood to influence the gut metabolome due to phage predation. We have been investigating the interaction between phages and *E. lenta* to determine the role phage infection may play in the colonisation of this bacterium in the human gut. Phase variation of human gut bacteria is increasingly understood to be an important mechanism by which host bacteria evade their phages, often by causing reversible changes to phage receptors on the host cell surface. We have identified the existence of a phase variation mechanism that potentially enables *E. lenta* DSM 2243 to switch between phenotypes of sensitivity and insensitivity to phage infection. The examination of phase variant genomes of the host bacterium shows the presence of large genomic inversions with junction points situated within gene clusters implicated in the biosynthesis of a capsular polysaccharides. We have investigated these genomic inversions to understand their influence on phage host infection.

**Keywords:** *Eggerthella*, bacteriophage, phase variation

## SCREENING AND MOLECULAR ENGINEERING OF ENDOLYSINS AS NOVEL ANTIBIOTICS

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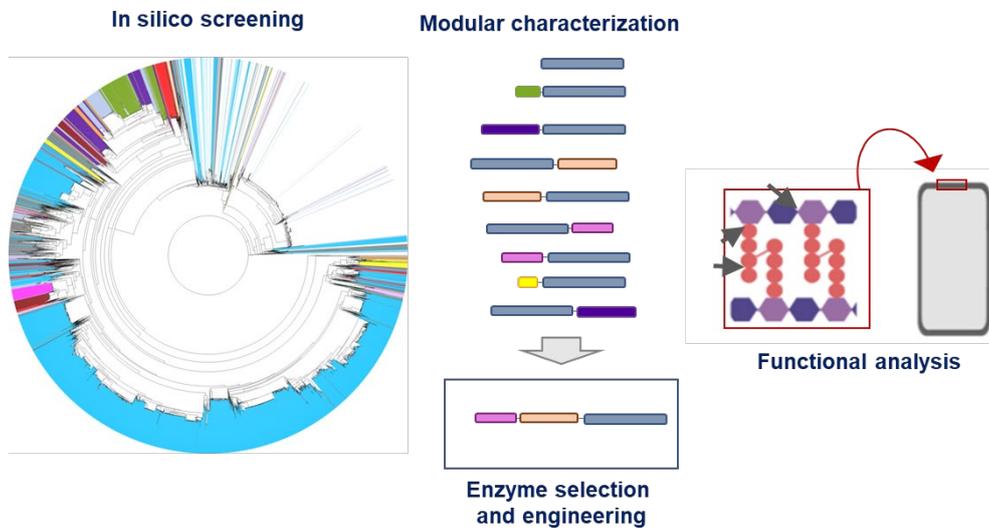
Endolysins are lytic enzymes that degrade the bacterial cell wall, promoting cell lysis. These and other related enzymes (collectively termed enzybiotics) are excellent candidates to replace antibiotics and synthetic biocides, as sanitizing agents in highly sensitive environments such as the food industry and hospital areas. Distinct advantages are their eco-friendly mode of action, based on high specificity and low propensity to generate resistance.

This work was aimed to identify, characterize and engineer novel lytic enzymes targeted to bacteria with high impact in the food and hospital environments, such as the Gram-negative *Escherichia coli* and the Gram-positive *Staphylococcus aureus* and *Listeria monocytogenes*. The modular character of these enzymes, combining enzymatic active domains (EADs) and cell wall binding domains (CBDs), was also considered. N-acetylmuramidases (families GH19 and GH24) and amidases (family Ami-2) were selected for this study because these EADs act upon conserved structural motifs in peptidoglycan. In all cases, the domain architecture of all the representatives of each family was analyzed and a phylogenetic analysis was carried out based on the corresponding EAD.

The results indicate that whereas GH24 is virtually a mono-domain family, ca. 40% of the sequences in the GH19 and Ami-2 families are multi-domain, including not only peptidoglycan binding modules but also domains with peptidase activity, in different combinations. Phylogenetic analysis identified clusters of enzymes potentially active against *Staphylococcus* and *Listeria* in the Ami-2 family, some of them with novel, non-canonical architectures, not reported previously. Bacterial lysis assays were carried out and confirmed that these enzymes were active against their expected targets.

A molecular engineering approach was carried out with a GH19 and a GH24 enzyme by generating chimeric constructs with peptidoglycan binding modules and peptidase domains. A 2-fold increase and 4-fold increase, respectively, in endolysin activity against permeabilized *E. coli* was achieved with one of the chimeric

constructs in each case, compared to the wild-type version. Since the representative of the GH19 family is one of the endolysins with highest reported activity against gram-negative bacteria up to date, this increase is a relevant result in the search of effective enzybiotics.



**Keywords:** endolysin, antimicrobial, amidase, N-acetylmuramidase, peptidoglycan

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## VALORISATION OF GRAPE SEED IN THE PRODUCTION OF FUNCTIONAL BISCUITS

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The development of bakery production requires stable activity of enterprises. The modern market of innovative technologies in the field of bakery allows the manufacture of nutritionally fortified or functional products with the use of wine by-products.

Under research laboratory conditions in the TPA department, when preparing experimental batches of crackers biscuits, the mass of wheat flour was partially replaced with that of grape seed (GSF) at the rate of 2 ÷ 8 % in relation to the amount of flour required according to the recipe. GSF (a mixture of flour seeds of the Pinot Grigio and Chardonnay ampelographic grape varieties, grown on the vineyards of the Criuleni district), presenting a non-gluten nutritional potential, can be used to obtain nutritionally improved products or functional products that have sensory qualities accepted by consumers and increased biological value.

The physico-chemical parameters of the GSF were determined according to the normative and legislative documents in the field of bakery. The results of the present research described the following values for GSF: humidity  $4.5 \pm 0.22\%$ , ash content  $2.66 \pm 0.28\%$ , lipid mass fraction  $13.4 \pm 0.17\%$ , protein mass fraction  $15.75 \pm 0.11\%$ , organic acid mass fraction  $2.5 \pm 0.02\%$ , total polyphenolic index  $25.4 \pm 0.3$ , total polyphenol content  $101,62 \pm 0,42$  mg AG/g d.s and anthocyanins content  $4,52 \pm 0,38$  mg M3G/g d.s.

Obtaining biscuits with the addition of FSS was done in a phase on the basis of the chemical aberrant. The dough samples of crackers biscuits with the addition of GSF showed high viscoelastic properties, the addition of GSF influenced the color of the biscuits, being darker due to the increased content of tannins. Water activity ( $a_w$ ) in experimental biscuits varied within  $0.17 \div 0.32$  value, decreasing moisture loss and decreasing the elasticity of the finished product.

**Keywords:** grape seeds flour, quality, fortification, functional biscuits

**Acknowledgment:** The research was funded by state project 20.80009.5107.09 «Improving of food quality and safety through biotechnology and food engineering», running at Technical University of Moldova.

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## **THE STUDY OF THE VINEYARD VARIETY - MERLOT FROM DIFFERENT VINEYARD AREAS**

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Red grapes have a fairly significant source of phenolic compounds, which possess very important physiological properties. Some of them go into the technological process of wine production and fundamentally participate in the organoleptic, physicochemical, and microbiological properties of the wine. A large part of them remains in the pomace and the passing percentage depends both on the quality of the grapes and on the methods of obtaining red wines. In this paper, the evolution of phenolic substances in pomace obtained from Merlot grapes from different areas of the Republic of Moldova was investigated.

Red Merlot grapes from the Nisporeni and Taraclia areas were used for research. The agrobiological, uvological, and microbiological composition of the Merlot grapes from the regions mentioned above was determined. The mass distribution of the parts of the Merlot berries was carried out. During the fermentation of the must from the Merlot grapes, the dynamics of the fermentation process was determined, which was carried out at a temperature of  $26 \pm 28^{\circ}\text{C}$ , in stainless steel tanks, in the microvinification section of the Department of Oenology and Chemistry.

After this, the physicochemical and specific indices were determined in the obtained raw material wines. The obtained pomace were separated from the pits, skin and seeds, then the humidity, alcohol content and tartaric acid content in the pomace were determined, then the pomace were dried at  $60^{\circ}\text{C}$ , ground and extracts were prepared with hydro-alcoholic solutions of different concentrations. The phenolic substances, the anthocyanins, were determined in the given extracts.

**Keywords:** grapes, fermentation, pomace, hydro-alcoholic solutions

## TRIBIOTIC EXOPOLYSACCHARIDES FROM A SELECTED *LACTIPLANTIBACILLUS PARAPLANTARUM* PROBIOTIC STRAIN

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Lactic acid bacteria (LAB) strains are able to synthesize and release into the fermentation media macromolecular carbohydrate-based compounds known as exopolysaccharides (EPS). The EPS production capacity relates on various intrinsic and extrinsic factors (microbial strain, metabolic pathways, growth conditions, and fermentation medium composition). Due to the antimicrobial, antioxidant, antiviral, and anticarcinogenic postbiotic properties, the bacterial EPS are one of the main interests of the scientists at the moment, considering also the prebiotic effect of these polymers. Consequently, the EPS need to be studied and exploited further for industrial applications based on their biotic properties. This work aimed at identifying the most suitable carbon source for a previously selected LAB strain of *Lactiplantibacillus paraplantarum* (MIUG BL 74) with probiotic potential to produce EPS. First, the selected LAB strain was cultured on de Mann, Rogosa and Sharpe (MRS) agar supplemented with different sugars (fructose, dextrose, glucose, mannitol, maltose, and sucrose) for 72 hours, at 37°C, in aerobic conditions. Then, sucrose and dextrose were selected and added (2% w/v) into three fermentation media composition based on colostrum, whey, and gluten-free flours. After the aerobic fermentation of the media for 72 h at 37°C, using 5% (v/v) inoculum of *Lactiplantibacillus paraplantarum* (MIUG BL 74), a deproteinization with trichloroacetic acid solution (4% w/v), followed by an ethanolic precipitation of the EPS from the supernatant was carried out. The EPS' yield was determined gravimetrically after dialysis (12-14 kDa) and drying at 50°C for 48 hours. The results suggest that the supplementation with sucrose of the complex gluten-free fermentation medium based on chickpea, quinoa, and buckwheat flours allowed the extracellular EPS' biosynthesis at a concentration of 8.92 mg EPS/g medium. Such experimental data emphasize the versatile metabolic properties of the selected probiotic LAB strains that can be beneficial upon complex food products' functionalization due to their tribiotic (pre-, pro-, and postbiotic) features, which can be correlated with the minimization of food additives' utilization.

**Keywords:** exopolysaccharides, *Lactiplantibacillus paraplantarum*, gluten-free flours, tribiotics, bioingredients

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## STRAWBERRY TREE (*Arbutus unedo*) AS A SOURCE OF FUNCTIONAL FRACTIONS FOR FROTIFICATION OF A SOFT CHEESE

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*Arbutus unedo* L. fruit is known for its high phenolic content, dietary fibers, and antioxidant capacity. It is a rich plant material but very little studied in terms of chemical composition and food valorization. The incorporation of this fruit in food is a promising tool for the upgrading of this product in the agri-food sector.

Thus, the main objective of this work was to characterize this plant raw material at two different maturation stages: immature stage of greenish color (SV) and mature stage characterized by a red color (SR). These fruits were then valorized by incorporating them into a cheese product in the form of extracts rich in phenolic compounds for the SV and of powder for the SR. In this context, decoctions were obtained from the fruit, lyophilized and then characterized. The effect of adding *A. unedo* fruit extract obtained using a water decoction on the physicochemical, DPPH-scavenging activity, textural and sensory properties of a soft “Sardaigne” cheese was studied.

The cheese, fortified with *A. unedo* extract, showed an increase in crude protein and firmness. Incorporation of the extract at 0.3 g/l increased the cheese yield, improved its DPPH scavenging activity after 5 days of storage and did not alter its color and sensory properties. These results suggested that addition of *A. unedo* extract to soft cheese at 0.3 g/l might be a functional ingredient with potential health benefits and good properties.

At the end of these results, we can propose the arbouise as a source of bioactive molecules that can contribute not only to improving the nutritional quality of cheeses, but also their functional characteristics, while being sensorily accepted by the consumer.

**Keywords:** *Arbutus unedo* L, Cheese, antioxidant activity, polyphenols

**COLD PLASMA ACTIVATED WATER PRETREATMENT AND DRYING OF *CENTELLA ASIATICA* LEAVES FOR THE EXTRACTION AND ENCAPSULATION OF BIOACTIVE COMPOUNDS USING LIPOSOME**

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The bioactive components found in *Centella asiatica* L. (CA), such as flavonoids and terpenoids, have attracted considerable commercial and research interest as a therapeutic remedy. Scientists and researchers in the food industry are investigating its phytochemicals for potential usage in various edible and drinkable products. But it must be dried first to last longer in storage. For this reason, CA leaves were pre-treated with blanching and cold plasma-activated water (CPAW) before being subjected to recirculatory hot air and vacuum drying at 40, 50, and 60 °C. Soy lecithin and stigmaterol were used to create liposomes, which were then used to encapsulate CA leaf extract (CALE). Particle size, zeta potential, FTIR, and scanning electron microscopy were all studied to see how they were affected by the different wall materials. In addition, liposome kinetics, thermodynamics, lipid oxidation, and thermal analyses were performed. AIC analysis revealed that R<sup>2</sup> values between 0.966 and 0.999 and RMSE values between 0.001 and 0.069 best represented the leaf drying kinetics data. Blanching did not improve leaf quality as much as CPAW pre-treatment. Antioxidants were found to be significantly higher after drying the leaves at 40 °C (4021.462 g TE (g dw)<sup>-1</sup> and 3.356 mg GAEAC (g dw)<sup>-1</sup>), as well as TPC (35.049 mg GAE (g dw)<sup>-1</sup>) and TFC (311.274 mg QE (g dw)<sup>-1</sup>). The generated liposomes were spherical, with an average vesicle size ranging from 512.67 to 787.78 nm. Encapsulation using soy lecithin and stigmaterol slightly modified the FTIR spectrum. CALE-loaded liposomes (CALE-LP) significantly reduce secondary lipid oxidation compared to the control. Research on thermal stability revealed difficulties in preserving the bioactive component at elevated temperatures. This research may help shape the direction of food-related technological advancements in the future.

**Keywords:** *Centella asiatica*, cold plasma activated water pre-treatment, drying kinetics, encapsulation, lipid oxidation.

**Acknowledgment:** Agricultural and Food Engineering Department, Indian Institute of Technology Kharagpur and Ministry of Education (formerly the Ministry of Human Resource Development), Government of India.

## OPTIMIZATION OF THE METHOD OF FORMING NANO-EMULSIONS AND THEIR CHARACTERIZATION

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Citrus essential oils are complex mixtures of volatile compounds with manifold possibilities to be used as active antioxidant and antimicrobial ingredients in food, cosmetics or pharmaceutical products. These uses are limited by their susceptibility to external factors such as light, temperature, pH, oxygen, and humidity. In order to enhance the physical-chemical stability of citrus essential oils, they were encapsulated into nano-emulsions. In this study, nano-emulsions were prepared through the ultrasonication method, using citrus oils as the lipidic phase and Tween 80 and ethanol as a surfactant, and co-surfactant respectively. Five types of citrus oil nano-emulsions were prepared by mixing 8% (v/v) of oil phase (bergamot, tangerine, orange, grapefruit, and lemon essential oils) with 1% (v/v) of Tween 80, 1% (v/v) of ethanol and 90% of deionized water using a magnetic stirrer and sonication at 72 amplitudes for 15 minutes. The PDI, turbidity, morphology, volatile profile, and bioactive properties were investigated, and their stability was monitored under different environmental conditions (storage at room temperature, at 37°C, refrigeration, freezing). Each emulsion exhibited different degrees of gravitational separation, the one stored at 37°C being the most unstable, showing coalescence. Gas chromatography-mass spectrometry (GC-MS) coupled with headspace solid phase micro-extraction (HS-SPME) was used to characterize the volatile fingerprint of nano-emulsions. Based on the results obtained from the chromatographic analysis, the main compound present in all studies was D-limonene with a concentration varying between  $103.804 \pm 8.112$  mg/kg and  $172.962 \pm 25.012$  mg/kg. In addition, other aroma compounds specific to citrus essential oils were identified, from the class of aldehydes, terpenes, and terpenoids, but in lower concentrations.

**Keywords:** nano-emulsions, citrus essential oils, optimization method, nanotechnology, chromatography

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## ANTIOXIDANT ACTIVITY OF BAKERY PRODUCTS WITH PROPHYLACTIC EFFECT

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The originality and novelty of the carried out research consists in the fact that it is proposed to obtain new bakery products with a prophylactic effect, which will be prepared from aproteic cereal flours with the addition of polycomponent preparations based on *Spirulina* within the framework of intensive technologies that present economic profitability and major benefits due to the high antioxidant and antiradical activity it possesses. It has been demonstrated that *Spirulina*-based preparations possess the ability to protect food products from microorganisms in the process of preserving them and ensure increased viability and the preservation of morphocultural characters. Thus, the possibility of using preparations based on *Spirulina* of cyanobacterial origin as agents to protect the product from microorganisms in the conservation process was demonstrated, also new recipes were developed for obtaining "Farrottini" breadsticks from rice flour and of soriz by stimulating the viability, the content of bioactive substances and the antifungal activity of the products, thanks to the addition of *Spirulina*.

For research, samples were obtained and selected from gluten-free, rice and sorrel flours, fortified with *Spirulina platensis* biomass, with the application of two procedures: the monophasic method, with a chemical softener (sodium bicarbonate) and the biochemical method (with compressed yeasts of bakery): PM rice - Breadsticks made from rice flour, SSP2 rice - Breadsticks made from rice flour with the addition of 6% spirulina biomass SP2, PM Soriz - Breadsticks made from rye flour and SSP2 Soriz - Breadsticks made from rye flour with the addition of 6% spirulina biomass SP2. In the finished products, TPC was determined by the spectrophotometric method, with the Folin Ciocalteu reagent (mg GAE·g<sup>-1</sup>). Research has shown that the gluten-free products obtained have a reduced TPC. As a result of the fortification of breadsticks with spirulina biomass, TPC increases in all samples, compared to samples without addition.

**Keywords:** "Farrottini" breadsticks, *Spirulina platensis*, prophylactic effect

## FUNCTIONAL CHARACTERIZATION OF THE SOY AND PEA DERIVED BIOACTIVE PEPTIDES

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The enzyme assisted hydrolysis was previously used for enhancing the functionality of the proteins from various sources. The objective of the study was to compare the effect of hydrolysis with pepsin and trypsin on the biological and functional properties of the soy and pea proteins. The technological functionality of the protein derivatives prior and after hydrolysis was determined in terms of foaming properties, emulsifying ability and rheological properties of the emulsions. The complementary experimental and *in silico* approaches were used to assess the biological activity of the soy and pea derived peptides. All protein hydrolysates exhibited significantly higher values of the emulsion activity index compared to the corresponding control, but the viscosity of the emulsion prepared with 0.5 oil fraction was lower. Regardless of the enzyme used for hydrolysis, a slight improvement of the foaming ability was observed in case of both protein derivatives when homogenization was done at 7000 rpm. The method based on scavenging the ABTS radicals showed that soy and pea proteins hydrolysis with pepsin and trypsin significantly enhanced the antioxidant activity. The peptides released by trypsin exhibited 3.9 and 1.4 more effective antioxidant properties compared to the initial pea and soy proteins, respectively. The *in silico* tools indicated that trypsin assisted digestion leads to 9 biologically active peptides with lengths between 7 and 20 amino acids in case of pea proteins, and 3 peptides in case of soy proteins. In conclusion, soy and pea proteins hydrolysis with the main digestive enzymes allowed the important enhancement of the biological and technological functionality of the protein derivatives.

**Keywords:** soy proteins, pea proteins, pepsin, trypsin, antioxidant activity, functional properties

## THERMO-MECHANICAL AND BAKING PROPERTIES OF THE GLUTEN FREE ZEIN – STARCH DOUGHS

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Zein is the most important protein fraction found in corn. In this study, different model mixtures consisting of zein and starch from various sources (native corn starch, modified corn starch and tapioca) were used to prepare gluten-free doughs and breads. The thermo-mechanical properties of the doughs were investigated by Mixolab using the Chopin+ protocol, whereas the gluten-free bread samples were characterized in terms of physico-chemical properties. The viscoelastic properties of the dough samples have been observed at 39°C and for different water absorption capacities (WAC) of 70, 77 and 98% for the native corn starch, modified corn starch and tapioca, respectively, and not at 30°C as in the case of the gluten based dough. The Mixolab curve registered for the zein-tapioca mixture presented a rebound at 53°C. The maximum gelatinization of starch (C3) was registered at: 89°C and WAC of 70% for zein-native corn starch samples (C3 of 2.54 Nm), 79°C and WAC of 70% in case of zein-modified corn starch sample (C3 of 2.64 Nm), and 84°C and WAC of 85% in case of zein-tapioca sample (C3 of 1.19 Nm). Samples with native corn starch and tapioca presented values of 0.74-0.79 Nm for breakdown, while for the modified corn starch based samples the breakdown of 0.55 Nm was registered. The highest specific volume of bread was registered for sample prepared with native and modified corn starch at high levels of WAC (77% and 85%, respectively). The crumb firmness varied with bread samples; the lowest values were measured for the bread samples prepared native corn starch (7.28 and 7.02 N) and tapioca at WAC of 98% (7.01 N). In conclusion, the zein-starch mixtures are promising for preparing gluten-free products.

**Keywords:** zein, starch, dough, thermo-mechanical properties, bread

## EVALUATION OF ANTIOXIDANT ACTIVITY AND BIOACCESSIBILITY OF POLIPHENOLIC COMPOUNDS OF YOGURT ENRICHED BY ALGINATE-ENCAPSULATED BASIL EXTRACTS

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Yogurt is widely consumed worldwide due to its nutritional and gastrointestinal health benefits and may represent an excellent matrix for incorporating ingredients and/or nutrients from various plant sources. The addition of aromatic plants or plant extracts allows obtaining yogurt with increased biological properties due to the presence of polyphenolic compounds. In this study, alginate-encapsulated basil extracts were added to yogurt in order to obtain products with functional properties. Yogurt samples with alginate-encapsulated basil extracts were subjected to the process of gastrointestinal digestion *in vitro*, after which the total polyphenol content and antioxidant activity (DPPH) of the yogurt samples during storage were determined. The results of the study demonstrated that the total content of polyphenols extracted from yogurt samples with alginate-encapsulated basil extracts after *in vitro* digestion was influenced by the concentration of alginate-encapsulated basil extracts. Increasing the concentration of alginate-encapsulated basil extracts in yogurt from 0.15% to 0.60% led to an increase in the total content of extracted polyphenols from 4.21 mg GAE/100 g to 17.84 mg GAE/100 g yogurt, which also led to a 1.12-fold increase in antioxidant activity. During the 30 days of storage, the total polyphenol content released in the yogurt with alginate-encapsulated basil extracts registered a constant increase. The retention of polyphenolic compounds during storage was 125.46% for the yogurt sample with 0.60% alginate-encapsulated basil extracts. Similar results were obtained for the other samples of yogurt fortified with alginate-encapsulated basil extracts. Therefore, sodium alginate encapsulation of basil extract was effective in stabilizing polyphenolic compounds during the 30 days of yogurt storage. The production of yogurt with alginate-encapsulated basil extracts brings together the beneficial qualities of yogurt components and the polyphenolic compounds found in basil extract. This result can be regarded as a functional food, offering enhanced health benefits.

**Keywords:** alginate-encapsulated basil extracts, *in vitro* bioaccessibility, antioxidant activity, phenolic compounds, yogurt.

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## GLUTEN-FREE FLOURS' METABIOTICATION AS AN EFFECT OF PROBIOTICS AND PARAPROBIOTICS

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The main objective of this study was to enhance the metabiotics (pre-, pro-, post-, and paraprobiotics) composition from the fermented product (FP) based of gluten-free flours and okara by employing viable and non-viable probiotic strains. The autoclaved fermentation medium was inoculated with 5% active culture of *Lactiplantibacillus paraplantarum* MIUG BL74 (OD<sub>600</sub> 2.0) and 10% of the paraprobiotic suspension of *Lactiplantibacillus plantarum* MIUG BL21 which was inactivated by ohmic heating (20V/cm, 15 min) combined with thermal treatment (75°C, 15 min). The fermentation took place in stationary system at 37°C for 72 h. Furthermore, the FP was freeze-dried at -30°C and 0.37 mbar (Christ Alpha 1-4 LD plus, Germany). The bioactive properties of the fermented product were analyzed. The survival rate of *L. paraplantarum* MIUG BL74 cells (log N/log N<sub>0</sub> x 100) in the FP was evaluated. DPPH and ABTS techniques were used to analyze the antioxidant activity. Peptides with 30 kDa molecular weight were separated by ultrafiltration, and their antioxidant and antidiabetic activities were assessed. The FP and peptides antipathogenic activity was evaluated against *Staphylococcus aureus* ATCC 25923, *Listeria monocytogenes* Scott A, and *Escherichia coli* ATCC 25922, respectively. HPLC analysis was used to establish the polyphenolics and short-chain fatty acids composition. The FP showed a DPPH/ABTS inhibition potential of 26.62%±0.24 and 22.62%±0.08, respectively. Similar values were recorded for the peptides as following 26.954%±0.808 (DPPH) and 23.816%±1.196 (ABTS). For separated peptides and for the FP non antidiabetic and antimicrobial effects were observed. The fermentation medium based on gluten-free flours, supplemented with 10% (v/v) paraprobiotics, ensured an improved multiplication and survival rate for the probiotic strain of 94.02%. The lactic, propionic, and isovaleric acids were evidenced in the FP. Syringic and ellagic acids, apigenin, caffeine, epigallocatechin, and a derivative of quercetin were quantified. An encouraging challenge, for the development of new foods, feeds, and bioingredients with increased functional activity, is the valorization of okara and gluten-free flours as the fermentation medium ingredients and selected probiotic strains as the promoters of metabiotication of the obtained products with increased bioactive properties.

**Keywords:** *Lactiplantibacillus* spp. metabiotics (pre-, pro-, post and paraprobiotics), bioactivity

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**FUNCTIONAL FOODS BASED ON HEMP AND BEE PRODUCTS.  
Bio HH & PP products**

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Currently, according to the regulations in force, the eligibility for the cultivation of hemp varieties has been established depending on the anatomical part of the plant and the THC content (up to 0.2%). In this legislative framework, Alcos Bioprod Ltd has certified as ecological the hemp (*Cannabis sativa* L.) that it grows with the purpose of using the seeds (as such, in powder form, for the extraction of fatty oils by cold pressing and as cake/crumb). This organic vegetable raw material is exploited in the form of a wide range of products, with different concentrations of CBD, from cosmetic-type ozonated oils to functional foods (in a mixture, to enhance the sanogenic effects, with beehive products).

The aim of the present study was to determine the phyto-active principles in the oil and protein powder obtained from organic hemp seeds, as well as the nutritional value of the finished product BIO HP&PP, a complex mixture of manna honey, hemp oil, Manuka honey MGO500, protein powder of hemp and propolis soft extract. The results of physicochemical and microbiological analyzes highlight the quality, complex composition, and safety of the product. In conclusion, it can be classified as a functional food



Figure: BIO HH & PP (2000 mg & 3000 mg)

**Keywords:** hemp, bee products, functional foods

## PRALINES WITH BEE PRODUCTS AND BLACK CHOCOLATE HAPPY WOMAN & HAPPY MAN PRODUCTS

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Dark chocolate 55 is an extra fine preparation with a content of 55% cocoa mass. It is ideal for flavoring, ganache, mousses, chocolate figures, tablets, and pralines or decorations. The intense bittersweet taste is specific to dark chocolate, and the texture is extra fine. In the form of pralines (chocolate-wrapped bee mixes), they are easier to portion and handle and can be sold in attractive packaging.

The purpose of this study (which involved documentation, physico-chemical, microbiological analyzes and technological tests at the pilot station of VitaPlant Săcel, Sibiu – certified as organic in 2022) was to obtain finished products in the form of bee mixes wrapped in chocolate. Thus, Happy Woman is a product in the form of pralines filled with a bee cocktail specially designed for women, made of: honey, pollen, propolis and royal jelly (the product is rich in minerals, enzymes, vitamins, amino acids and trace elements and has tonic and immunoregulatory). Royal jelly is a hormonal regulator, thus contributing to maintaining the health of the reproductive system (recommended for women who want to procreate, those who are in menopause or those with hormonal imbalances).

Happy Man pralines contain, wrapped in 55% dark chocolate, a natural bee mix of: honey, pollen, propolis and Apilarnil. Many scientific studies attest to the role of apilarnil in maintaining and balancing male sexual functions, attributing to it aphrodisiac, mineralizing, vitaminizing, immunomodulating, toning, energizing and increasing endurance properties. Thus, the products from the Happy range contribute to maintaining the body's vitality, can help maintain tone and increase muscle mass, being mixtures of natural products that support the body's homeostasis.



Figure: Happy Woman & Happy Man (praline)

**Keywords:** pralines, happy woman, happy man

## PROBIOTICS SURVIVAL IN PARAPROBIOTICS-ENRICHED FERMENTED PRODUCTS AFTER FREEZE-DRYING

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Freeze-drying is a commonly used technique for the preservation of lactic acid bacteria (LAB). To improve cells' survival rate during freeze-drying and long term storage, it is crucial to select adequate freeze-drying parameters. The aim of the present study was to evaluate the probiotics' survival in paraprobiotic-enriched fermented products (FPs) after freeze-drying. The FPs (samples coded FP-Cs and FP-Ws) were obtained first by the fermentation of some unconventional substrates (bovine colostrum and whey protein isolate) by using a selected probiotic strain *Lactiplantibacillus paraplantarum* MIUG BL 74. Then, the fermentation media were supplemented with *Lactiplantibacillus plantarum* MIUG BL 21 culture's paraprobiotics. Specifically, the fermentation media based on 8% (w/v) bovine colostrum and 8% (w/v) whey protein isolate were sterilized at 105°C for 10 minutes. Then, the sterile media were inoculated with 5% (v/v) fresh probiotic culture of *Lactiplantibacillus paraplantarum* MIUG BL 74 (optical density 2.0 at the wavelength of 600 nm). The paraprobiotics suspension of *Lactiplantibacillus plantarum* MIUG BL 21 was obtained after cells' inactivation by ohmic heating (20 V/cm, 15 min) combined with thermal treatment (75°C, 15 min). The impact of 10% (v/v) paraprobiotics was studied by adding them before (samples coded FP-C2 and FP-W2), respectively after fermentation (samples coded FP-C3 and FP-W3). Controls represented by the fermented media without paraprobiotics (samples coded FP-C1 and FP-W1) were also evaluated. All the experimental variants were fermented at 37°C for 72 h, under aerobic conditions. The viability rate of *Lactiplantibacillus paraplantarum* MIUG BL 74 cells ( $\log N/\log N_0 \times 100$ ) from the FPs was determined in aerobic and anaerobic conditions, using fresh FPs or samples resulting after freeze-drying at -30°C and -42°C. The obtained results demonstrated that the fermentation medium based on 8% (w/v) bovine colostrum, supplemented before fermentation with 10% (v/v) paraprobiotics, ensured an improved multiplication and survival rate for the probiotic strain. A freeze-drying temperature of -30°C is recommended for increased probiotic viability in the FPs. Therefore, the probiotic counts (CFU/g FP) in aerobic and anaerobic conditions were not significantly different for all obtained FPs.

**Keywords:** *Lactiplantibacillus* spp., probiotics, paraprobiotics, fermented products, freeze-drying

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## THE INFLUENCE OF THE ADDITION OF SEA BUCKTHORN POWDER ON THE RHEOLOGICAL PROPERTIES OF WHEAT FLOUR DOUGH

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Sea buckthorn berries are well known for their high content in bioactive compounds and became more and more researched in recent years, especially for their application in food production. This research presents the influence of the addition of organic sea buckthorn powder 4%, 6%, 8% and 10%, obtained from 3 varieties of fruit, namely Mara, Sorana and Clara, on the rheological properties of dough made with wheat flour, type 650. It was found that the presence of organic acids and soluble fibers from sea buckthorn fruit influenced the rheological properties of the dough with the increase of the percentage added and the variety from which sea buckthorn flour is obtained. The results also showed that the development time of the dough, the stability, the gelatinization of the starch and the enzymatic activity were influenced by the increase in the percentage of sea buckthorn flour and also by the variety used. Further, the higher the percentage of added sea buckthorn powder, the more resistant the dough is to processing.

**Keywords:** sea buckthorn powder, dough properties, rheological properties

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## ENHANCING BREAD QUALITY THROUGH THE ADDITION OF DEHYDRATED SOURDOUGH IN THE WHEAT FLOUR

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Sourdough, a time-honored biotechnological technique utilized for millennia, stands as one of the oldest techniques in food production. In modern times, incorporating sourdough into bakery product manufacturing has proven to elevate texture, flavor, and microbiological shelf life. The fermentation process relies on a harmonious relationship between yeast and specific lactic acid bacteria. The integration of dehydrated sourdough has emerged as a promising technological solution to seamlessly and profitably infuse traditional bread qualities into industrial production. This study aims to investigate the impact of incorporating dehydrated sourdough on the physicochemical and sensorial properties of whole meal and white bread. Evaluated characteristics include overall acceptability, crumb appearance, acidity, porosity, flavor, aroma, volume and elasticity. The findings of this research demonstrate a marked improvement in bread quality achieved through the utilization of dehydrated sourdough. The bread exhibited increased acidity, improved elasticity, and enhanced porosity, resulting in higher volume and overall acceptability. Furthermore, the flavor and taste were deemed more pleasant. Leveraging technological aids like sourdough not only elevates bread quality but also extends its shelf life.

**Keywords:** shelf life, dehydrated sourdough; bread, sensory properties

## ENZYME APPROACHES APPLY TO HIGH-PURITY XOS PRODUCTION FROM WHEAT CHAFF

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Agricultural residues composed of the carbohydrates-lignin complex structure are the most abundant biomass available in the world, and wheat chaff, as an underutilized lignocellulosic material, could be a good source for XOS producing that could contribute to sustainable development and economy. Xylooligosaccharides (XOS) are short-chain oligomers with diverse biological and functional effects. They have attracted commercial interest due to their potential application as ingredients in functional food products and the cosmetic industry. However, after the production of XOS from lignocellulose biomass, unwanted compounds such as glucose and xylose are presented. These impurities might change the sweetening power of XOS as well as increase XOS calorie value are occurring. In addition, its low purity level could decrease XOS biological activities.

However, the extraction of arabinoxylan components for producing XOS from lignocellulose is tricky due to the cross-linkage of arabinoxylan with other components in cell wall wheat chaff. Therefore, in this study, XOS production is caring by enzymatic extraction of arabinoxylan component from wheat chaff followed by applying three commercial endo- $\beta$ -1,4-xylanase hydrolysis. The enzymatic process is more environment-friendly than other strategies, operating without chemicals, and could be high-controlling in producing unwanted components. Due to wheat chaff's complex structure cell wall, amylase and protease were used for arabinoxylan extraction and simultaneous removal of protein and starch impurities.

Further, three commercial xylanases are used for arabinoxylan hydrolyzing to produce XOS in a high yield of 108, 104, and 236 mg XOS/g DM. Xylopentaose was the predominant oligomer in all hydrolysates, and the high purity achieved in this process was 91%. Therefore, the enzymatic approach could be useful for producing high-purity XOS that will be excellent as antioxidants and for future research exploring incorporation in food.

**Keywords:** XOS; enzymes; high-purity; wheat chaff

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## **CAPSULES OF BEETROOT BY-PRODUCT EXTRACT PRODUCED BY ELECTROHYDRODYNAMIC METHODS**

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The recent food trends have transitioned towards a more healthy and nutritious products, which shifted the eating habits to foods with proven bioactivity. Food functionalization with bioactive compounds can play an active role in diseases prevention. However, bioactive compounds in a free form are usually not stable. Thus, it is crucial to apply adequate methods to protect them from degradation with the purpose to deliver a controlled release. One of the methods to protect the sensitive bioactive compounds and ensure their stability is coating them in protein-polysaccharide conjugates, and warrant a long-term stable form, followed by spray drying microencapsulation.

Another way to produce capsules in dried form is electrospraying that offers the possibility of particles` production with wide size range depending on liquid flow rate, applied voltage and liquid electric conductivity. Protein-polysaccharide conjugates based on the Maillard reaction have been gaining a lot of recognition for the encapsulation of bioactive compounds in food.

The aim of this study was to test the efficiency of ultrasound assisted thermal processing for obtaining whey protein concentrate-maltodextrin (WPC:MDX) conjugates as coating materials, for bioactive compounds extracted from beetroot waste, in order to produce a functional ingredient. Moreover, the novel method of electrospraying was applied to produce encapsulated particles.

The WPC:MXD solution (5% w/v), 1:1 (v/v) ratio, was prepared in deionized water, hydrated overnight in deionized water at pH 8.0. The mixture was exposed to US (35% amplitude, 500W, 1h) then a supplementary thermal treatment (TT) at 70, 80, or 90°C for 1 h was performed to obtain conjugates C1, C2 and C3 respectively, then freeze dried. Afterwards, 20% (w/v) solutions were prepared with C1, C2 and C3, and 3% w/v the beetroot extract was added and submitted to electrospraying.

The conjugates were analyzed for the glycation and capsules were characterized for their physicochemical properties: encapsulation efficiency, morphology, color and

glass transition temperature. The C1 conjugate displayed the highest degree of glycation obtained by US and TT at 70°C the displayed, while comparable encapsulation efficiency was obtained for C1 and C3.

**Keywords:** electrospaying, encapsulation, conjugation, beetroot extract

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## **VALORIZATION OF FOOD PROCESSING BY-PRODUCTS IN NEW FOOD MATRICES FOR BETTER ENVIRONMENTAL SUSTAINABILITY**

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This paper is based on a review of valorization directions, mainly of vegetable and animal nettle by-products, for the purpose of environmental sustainability. The present review is based on a bibliographic study of 68 articles published between 2001-2023 and tried to identify the need for the valorization of agro-industrial by-products, as well as the most used methods of valorization of these wastes with nutritional value, but also from the point of view of environmental sustainability. Cascading waste recycling is the engine of the circular bioeconomy that supports finding solutions to environmental, economic, social, ethical, etc. problems. Waste recovery methods and procedures are diversified depending on the type of waste. Moreover, in-depth studies, an appropriate legislative framework, innovative technologies and alternative solutions, etc., are needed for the circular bioeconomy engine to "work".

**Key words:** vegetable by-products, animal by-products, sustainability, processing methods, trends and perspective.

## RESEARCH ON THE VALORIZATION OF GRAPE POMACE INTO FUNCTIONAL BIO-INGREDIENTS

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Grape pomace stands as the primary solid residue produced by the wine industry after grape pressing and fermentation. Approximately 20% of whole grapes are generated as pomace, contributing to a staggering global annual yield of over 10 million tons of grape pomace. Red grape pomace, abundant and economically viable, presents fascinating prospects in functional ingredients, foods, and nutraceuticals due to its extensive bioactive profile. In this study, we explore the impact of different drying methods on *Băbească neagră* grape pomace purée inoculated with probiotic *Lactobacillus casei* ssp. *paracasei* (*L. casei* 431®).

The investigation employs a kinetic model and evaluates the survival rate of the probiotic bacteria. The findings reveal that temperatures within the range of 40°C to 50°C reduced the drying time and increased the drying rate. Infrared drying, in particular, yielded the shortest drying time, preserving the bioactive compounds, lactic acid bacteria, and color effectively. The effective diffusivity values were higher for infrared drying, resulting in a lower activation energy. Both powders obtained showed a minimum of 7 log CFU/g DW (colony-forming units per gram of dry weight).

Based on these results, the powders dried at 45°C were selected for further analysis, including spectral analysis, chromatographic advanced analysis, and evaluation of the inhibitory effect on metabolic syndrome-associated  $\alpha$ -amylase. The liquid chromatography revealed a rich phenolic profile, encompassing various anthocyanins, flavanols, stilbenes, and phenolic acids. The primary anthocyanins identified were cyanidin-3,5-*O*-diglucoside and malvidin-3-*O*-monoglucoside, with similar concentrations in both powders.

Nevertheless, the infrared-dried sample displayed a 25 nm red-shift in peak, possibly attributed to differences in bioactive components. The anthocyanins demonstrated a significant impact on  $\alpha$ -amylase, leading to conformational changes driven by hydrophobic interactions, as observed through fluorescence quenching. The infrared powder exhibited higher IC<sub>50</sub> values, correlating with its elevated bioactive content. These results suggest that infrared drying could serve as a viable method to preserve the quality of *Băbească neagră* grape pomace purée, making it a promising option for various applications in the food and industrial sectors.

**Keywords:** grape pomace, water activity, drying method, polyphenols.

## SMART VALORIZATION OF RESIDUAL RESOURCES: CHALLENGES FOR THE HEALTH AND SAFETY OF THE SOIL- FOOD AXIS

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Nowadays, Romania has the biggest environmental problems due to the release of residual resources, also known as industrial waste and byproducts, into the environment. The social and economic need to restore healthy environments, that have an impact on enhancing the quality of life, leads to the recommendation of recently developed bioremediation processes, as important and effective approaches to remove contaminants from soils. In this context, as part of the complex RDI project intitle *Establishing and operationalizing a Competence Center for Soil Health and Food Safety (CeSoH)* (PNRR-III-C9-2022 - I5, Project code 2), the specific project intitle *Innovative and emerging solutions for smart valorisation of residual resources impacting health and safety of soil-food axis* (InnES) provide innovative and emerging solutions for appropriate low-cost methodologies in order to contribute to the re-construction and restoration of soil, by combining different bioremediation methods, such as bioaugmentation, biostimulation and composting. Thus, the research is devoted to a field which will bring together emerging issues in engineering, biotechnology, environment, agriculture and food industry, based on developing cutting edge technologies. In this regard, the combination of the selected processes can be an attractive due to their synergetic effect allowing to enhance the elimination levels of contaminants achieved individually. The activities target to design a tailored, easy-operation, cost-effectiveness and eco-friendly biocomposites from recycled resources as a candidate for sustainable bioremediation, allowing to develop a closed-loop system from two different industries, impacting especially the quality of soils and of foods. The designed biocomposite will be based on slag, dolomite, grape pomace and wine lees, while enhanced performance in soil restoration when compared with physico-chemical methods are expected. Also, will be designing biocomposites with electrofilter dust (CKD). The approaches developed involves an integrated approach based on exploratory and applied research, aiming to provide novel, safe, bio-based alternatives for soil recovery.

**Keywords:** soil, industrial and agri-food wastes, biocomposites, bioremediation, safety

**Acknowledgments:** This research was supported by project Establishment and operationalization of a Competence Center for Soil Health and Food Safety-CeSoH, Contract no.: 760005/2022: Innovative and emerging solutions for smart valorisation of residual resources impacting health and safety of soil-food axis (InnES-Innovation, Emerging, Solutions-Soil), Code 2, financed through PNRR-III-C9-2022-I5 (PNRR-National Recovery and Resilience Plan, C9 Support for the private sector, research, development and innovation, I5 Establishment and operationalization of Competence Centers).

## THE EFFICIENCY OF EXPERIMENTAL ACTIVATED CARBONS FROM VEGETABLE WASTE IN REDUCING THE RISK OF OXIDATION IN WHITE GRAPE MUSTS

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One of the major issues in wine production is their oxidation during the winemaking process, which is manifested by a significant decrease in organoleptic qualities, particularly the reduction of varietal aromas, and primarily affecting chromatic characteristics. Pre-fermentative and alcoholic fermentations of grape musts, as well as post-fermentative oxidation of young wines, are mainly determined by the oxidation of polyphenolic substances in grapes. These processes are catalyzed by oxidative enzymes such as polyphenol oxidase (PFO), laccase, tyrosinase, and during the formation of wines, by transitional metal compounds with variable degrees of oxidation (Fe, Cu, Mn). To minimize enzymatic oxidation of white grape musts, experimental activated carbon (AC-C) obtained from peach pits was studied. The study used musts obtained from healthy grapes and grapes infected with mold from both local white grape varieties (Feteasca Regală, Viorica, Legenda) and European varieties (Sauvignon Blanc, Pinot Gris), from different geographical regions. Enzymatic activities of PFO, concentrations of polyphenolic substances, and trichromatic characteristics were monitored over time. The subsequent antioxidant protection provided by activated carbon occurs through two mechanisms: 1) reducing the content of PFO and 2) decreasing the concentration of oxidizable polyphenolic substances. For Pinot Gris grape must, both healthy and affected by *Botrytis Cinerea*, using the maximum allowable norm of activated carbon (according to OIV regulations) - 1 g/l - reduced the enzymatic activity of PFO by 4-5 times compared to untreated musts. For other grape varieties, the reduction in enzymatic activity was more modest. In untreated musts from healthy Pinot Gris grapes, the PFO enzymatic activity decreased by approximately 33% over a period of 168 hours, while in the case of musts from *Botrytis*-affected grapes, the activity remained unchanged. In all cases of applying AC-C, the chromatic parameters undergo changes due to the gradual elimination of polyphenolic substances. This can be adjusted as desired by modifying the quantities of AC-C added. Therefore, the use of activated carbons obtained from food industry waste can be an efficient option to reduce the risk of enzymatic catalyzed oxidations in the production of white wines.

**Key words:** white grapes, must, polyphenol oxidase, browning, activated charcoal

**Acknowledgements:** The research was funded by State Project 20.80009.7007.21 „Reducing the impact of chemical, toxic substances on the environment and human health through the use of absorbents and catalysts obtained from domestic raw materials” running at the Technical University of Moldova.

## ELIMINATING THE PINKING EFFECT IN WINES USING ACTIVATED CHARCOAL

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The use of reducing technologies in the production of white wines, aimed at preserving varietal aromas, fruitiness, and freshness while preventing their oxidation, may have an unexpected impact on their visual appearance - pinking. Although the mechanism of this phenomenon is not yet well understood, it is believed to be caused by the oxidative transformation of certain colorless proanthocyanidins into their respective red-colored cyanidins. Pinking can occur in wines stored in tanks as well as bottled wines. In the pre-bottling stage, pinking can be removed through various methods such as treatment with sorbents, addition of SO<sub>2</sub>, etc.

As a sorbent for eliminating the substances responsible for pinking, activated charcoal CA-M30 obtained from peach pits, waste from canning factories, was tested in the Ecology Laboratory of the Institute of Chemistry at the State University of Moldova. The concentrations of proanthocyanidins were determined in over 20 white wines of various varieties produced in different regions of the Republic of Moldova using different techniques. Their content varies widely, ranging from 0.9 mg/l (Sauvignon Gris) to 230.8 mg/l (Alb de Onțcani). The oxidizability does not correlate with the concentration of proanthocyanidins or with the total phenolic content. Neither does the Pinking-test correlate with these parameters. CIELa\*b\* analysis demonstrated a significant increase in the a\* coordinate, an indicator of the red component, in most wines subjected to the test. The anthocyanin content in wines with pinking was also determined, ranging from 0.1 to 2.7 mg/l, with Sauvignon Blanc from the skin maceration variant being the most sensitive to pinking.

Additions of activated carbon CA-M30 completely eliminated pinking, just like additions of PVPP and SO<sub>2</sub>. The pigments adsorbed by CA-M30 were recovered in a hydroethanolic solution (10% v/v, pH 3.60) using ultrasonication (20 kHz) and studied spectrophotometrically, including by second-derivative analysis.

The elimination of pinking in wines most susceptible to this effect was efficient when treated with CA-M30 at concentrations of up to 200 mg/l, with concentrations of 80 mg/l being sufficient in most cases.

**Keywords:** white grapes, must, polyphenol oxidase, browning, activated charcoal

**Acknowledgements:** The research was funded by State Project 20.80009.7007.21 „Reducing the impact of chemical, toxic substances on the environment and human health through the use of absorbents and catalysts obtained from domestic raw materials” running at the Technical University of Moldova.

**PHYTOCHEMICAL CHARACTERIZATION OF A CARROT EXTRACT  
BY UHPLC-MS/MS**

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Phytochemicals are generally regarded as research compounds rather than essential nutrients due to their beneficial health effects and they comprise several major categories, such as carotenoids and polyphenols, which include phenolic acids, flavonoids, stilbenes or lignans. These types of compounds are empirically defined as antioxidants that protect the cells against free radicals, which can in term cause damage and disease. As such, the need arises to thoroughly characterize every single class of biologically active compounds to better understand their biological activities. Carrots are amongst the most consumed types of vegetables worldwide, being rich in functional phytochemicals such as vitamins, minerals, fiber and polyphenols. In order to characterize the experimentally obtained carrot extract, a UHPLC-MS/MS chromatographic analysis was performed to assess the presence of several classes of biologically active compounds, namely polyphenols and carotenoids. Moreover, the concentration of polyphenols compounds was approximately 0.544 mg/g DW extract while the content of total flavonoids was 0.326 mg/g DW extract. The chromatographic analysis revealed the presence of several compounds, the major compounds being lutein, lycopene,  $\beta$ -carotene and their derivatives.

**Keywords:** carrot, biologically active compounds, UHPLC-MS/MS

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**MULTIDIMENSIONAL APPROACHES  
FOR AQUACULTURE AND AQUATIC  
RESOURCES SUSTAINABILITY**

## AN OVERVIEW OF COLD-BLOODED ANIMALS (FISH AND REPTILES) ZONOTIC DISEASES, PAST, PRESENT AND FUTURE

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**Purpose:** In recent years, the importance of zoonotic diseases between humans and cold-blooded animals such as Fish and Reptiles has doubled due to the increasing demand for such animals. The World Health Organization identifies zoonosis or diseases that can be transmitted between humans and animals as diseases or infections that are naturally transmitted between humans and vertebrates.

**Results:** According to the available information, out of 1415 infectious disease agents in humans, more than 868 (about 61%) are zoonosis and its source is wild or domestic animals, while among these 175 emerging or re-emerging pathogens, 132 of them (75 Percent) are zoonosis. Therefore, it is estimated that about 250 foodborne pathogens are among the causes of zoonosis.

On the other hand, due to the urgent human need for protein sources of aquatic origin, the use of various water resources to increase aquaculture production is increasing day by day in the world. Although these animals may even seem physically healthy, they can carry dangerous diseases that Stress conditions occur and cause serious infections in humans. Viral, protozoan, fungal, parasitic, and especially bacterial infectious diseases can infect cold-blooded animals.

Such pathogens can be transmitted to humans in addition to the animal itself and are important for public health. *Borcholderia pseudomale* is transmissible from iguana to humans. According to searches, bacterial zoonotic agents are divided into two groups: gram-positive (*Mycobacterium*, *Streptococcus*, *Erysipelothrix*) and gram-negative (*Aeromonas*, *Vibrio* and *Enterobacteriaceae* family) and other such as

*Salmonella*, *Mycobacterium*, *Chlamydothyla*, *Aeromonas* and *Pseudomonas* are also very important among zoonotic bacterial diseases.

Fungal infections include *Aspergillus*, *Candida*, *Cryptococcosis*, *Chrysosporium*-related fungi, and other fungal agents. *Cryptosporidium* and *Purospthalus* are also common parasitic diseases. Captive species treat humans calmly but can inflict significant casualties on their owners by biting. Other factors influencing the transmission of zoonotic diseases include the exposure of the owners of these animals to contaminated feces, as well as the consumption of meat and reptile products in some communities, which can be important in creating zoonotic diseases.

**Conclusion:** This article reviews the importance of these issues and tries to address the diseases Investigate the zoonotic between humans and fish or reptiles as pets.

**Keywords:** Zoonotic diseases, Human, Fish and Reptiles

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**THE PRESENCE OF ORGANIC POLLUTANTS IN MUSSELS  
(*MYTILUS GALLOPROVINCIALIS*) ON THE BLACK SEA COAST**

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During 2019, expeditions were carried out from the Romanian Black Sea area with the sampling of molluscs (*Mytilus galloprovincialis*). The aim of the study was to quantify the organic pollutants (polycyclic aromatic hydrocarbons, organochlorine pesticides and polychlorinated biphenyls) present in these organisms to evaluate the compliance with maximum admissible levels according to legislation in force. Quantifying the degree of mussel pollution has a very important role due to their filtering role and thus the health of the marine ecosystem in that area can be assessed. Organic pollutants are receiving increased attention because of their accumulation potential, posing thus a threat to the marine ecosystem and a potential risk to human health through the consumption of aquatic organisms.

**Keywords:** Black Sea, organic pollutants, *Mytilus galloprovincialis*

**EFFECTS OF INDUSTRIAL HEMP SEED INCLUSION IN  
VEGETAL DIET ON GROWTH PERFORMANCE AND  
NUTRITIONAL COMPOSITION OF COMMON CARP (CYPRINUS  
CARPIO) IN A RECIRCULATING AQUACULTURE SYSTEM**

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The present study aimed to investigate the effects of incorporating industrial hemp seeds (*Cannabis sativa*) into a vegetal-based diet on the growth performance and nutritional composition of common carp (*Cyprinus carpio*) with an average initial weight of 122 g in a recirculating aquaculture system (RAS). Four experimental diets were formulated with varying inclusion levels of industrial hemp seeds (0%, 5%, 10%, and 20%) in combination with sunflower mill, barley, maize, and distiller's dried grains with solubles (DDGS). A six-week feeding trial was conducted, during which key growth parameters including weight gain, specific growth rate, and feed conversion ratio were measured. Additionally, the nutritional composition of the fish, including protein, fat, and ash content, was analyzed. Water quality parameters were closely monitored throughout the trial to ensure optimal conditions for fish growth. These results hold promise for the development of sustainable and nutritious feed formulations for freshwater fish species. Further research is needed to explore the potential mechanisms of action and to optimize the dietary inclusion levels of industrial hemp seeds for optimal fish production.

**Keywords:** *Common carp*, industrial hemp seeds, RAS

**Acknowledgment:** This study was supported by Research and Development Station for Aquaculture and Aquatic Ecology

**INCREASED PROFITABILITY IN FISH FARMS BY CREATING A MICROCLIMATE CONDUCIVE TO ALGAL GROWTH IN A POND COVERED WITH PREDATOR NETTING BY INTRODUCING A HIGHER PROPORTION OF PHYTOPLANKTON CONSUMING FISH SPECIES AND OBTAINING A SECONDARY PRODUCTION OF THE CLAM ANODONTA CYGNEA**

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The exploitation of all the aquatic resources available in an area set up for the rearing of native farmed fish is essential, both from an economic point of view and from the point of view of the well-being of the population itself. Uncontrolled development of phytoplankton and the entire submersed and immersed substrate in the water source can lead to a depletion of the water source and a decrease in the planned production. Adequate consumption of the basin's natural resources facilitates a symbiosis between the existing population and the environment, i.e. a controlled development of these plus the established addition of feed leads to an increase in total production. Protective nets placed above the pond help to form a specific microclimate, which modifies certain environmental indicators. A thorough knowledge of these variations is necessary to control possible disturbances. Further development of secondary consumer classes in the studied arrangement, such as pond shells, leads to a more efficient use of the available resources. At the same time, there are a number of advantages of supporting all food chains in terms of increased production and lower costs involved in the process. Maintaining the quality parameters of the water used in fish farming/aquaculture is of particular importance and plays an essential role in the smooth running of the process itself. The present study refers to the monitoring of physico-chemical, hydrobiological parameters and the relationship between the main consumer class in the fish pond (fish) and the other links in the food chain following the principle of integrated multi-trophic aquaculture.

**Keywords:** aquatic resources, environment, microclimate, protective nets, shellfish.

## **ECONOMIC INCENTIVES FOR ENVIRONMENTAL SERVICES IN AQUACULTURE: PROMOTING SUSTAINABLE PRACTICES AND PROTECTING THE AQUATIC ENVIRONMENT**

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The aquaculture industry plays a vital role in ensuring food security and global economies. However, the rapid expansion of this sector has raised concerns about its impact on the environment and the preservation of aquatic ecosystems. To address these challenges, the concept of payments for environmental services (PES) has emerged as an innovative approach to incentivize and promote sustainable practices in aquaculture, while also ensuring the protection of the surrounding environment

This article aims to explore the significance of economic incentives within the context of aquaculture, emphasizing the implementation of PES as a tool to encourage environmentally responsible practices among aquaculturists. By providing financial rewards or other benefits, PES programs encourage industry players to adopt practices that enhance biodiversity conservation, mitigate pollution, and foster sustainable resource management. The adoption of PES in aquaculture can be a transformative step towards balancing economic growth with environmental preservation. By creating a symbiotic relationship between aquaculture and ecosystem services, PES offers a promising pathway to achieve both sustainable resource utilization and the conservation of vital aquatic habitats. As global demand for aquaculture products continues to rise, strategic integration of PES programs becomes increasingly crucial for achieving a harmonious coexistence between human activities and nature. The adoption of PES in aquaculture can be a transformative step towards balancing economic growth with environmental preservation.

By creating a symbiotic relationship between aquaculture and ecosystem services, PES offers a promising pathway to achieve both sustainable resource utilization and the conservation of vital aquatic habitats. As global demand for aquaculture products continues to rise, strategic integration of PES programs becomes increasingly crucial for achieving a harmonious coexistence between human activities and nature.

**Keywords:** aquaculture, economic incentives, environmental services, sustainable practices, biodiversity conservation

**COMPARATIVE STUDY ON THE EFFECT OF *ULVA LACTUCA*  
AND *SPIRULINA PLATENSIS* ON THE IMMUNE-OXIDATIVE  
STRESS BIOMARKERS AND SERUM BIOCHEMICAL  
PARAMETERS OF *CYPRINUS CARPIO* EXPOSED TO IMAZALIL**

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The fungicide imazalil (IMZ) is widely utilized to maintain freshness, inhibit decay, and manage fungal infections in fruits, vegetables, and other plants. Recently, certain studies have indicated that its presence in aquatic environments has reached alarming concentrations. In the last years the studies showed that this fungicide has negative impacts on aquatic organisms inducing developmental abnormalities, gut microbiota dysbiosis, and disruptions in hepatic metabolism. Recent research has also shown that oxidative stress is a significant response to environmental chemicals in animals. The liver, being the primary organ for metabolizing exogenous substances, is particularly vulnerable to oxidative stress. Algae are commonly used in fish feed, and they can play an important role in protecting fish from toxicity. Algae are a rich source of essential nutrients, including proteins, lipids, vitamins, minerals, and other bioactive compounds. When included in fish feed, algae can provide several benefits for the fish such as detoxification and protection of fish cells from oxidative stress, strengthening the immune system, enhancing growth and overall health making them better equipped to cope with potential toxicity challenges.

The aim of the present study was to evaluate the potential of two algal species *Ulva lactuca* and *Spirulina platensis* to block or diminish the negative physiological effects of imazalil on carp (*Cyprinus carpio*) fingerlings. Therefore, the experimental groups were exposed simultaneous to the fungicide (5mg/kg feed) and fed with feed containing: only *Ulva lactuca* (IMZul variants – 5% ulva), only *Spirulina platensis* (IMZsp variants – 5% spirulina) or both algae (IMZul\_sp variants – 2,5% ulva and 2,5% spirulina). In the experiments we used also 2 control variants: a negative control receiving normal feed and a positive control receiving feed with 5mg/kg imazalil. For each variant have been use 15 fish/tank. In the end of the experiment 5 fish from each tank were used for biological samples. The biochemical serum parameters and oxidative stress markers were quantified for each exemplar. The results showed that algae have a significant potential to counter the negative effect of imazalil.

**Keywords:** imazalil, algae, bioactive compounds, oxidative stress, serum biochemistry, carp.

## MICROBIAL CONTAMINANTS OF FISH AND FISH PRODUCTS

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The microbial quality of fish and fish production is a significant aspect of food safety. Fish is a highly perishable food that requires proper handling and preservation. Spoilage and pathogenic bacteria associated with fish, and fishery products can be classified into three general groups: indigenous bacteria belonging to the natural commensal microflora of fish, exogenous enteric bacteria from surrounding polluted water and bacterial contamination during processing, storage or preparation for consumption. It is considered that microbial spoilage is a major cause in transforming the fish muscle from acceptable to unacceptable raw material for food industry. In a vast study regarding the microflora adhering to the processing equipment during production, including after cleaning and disinfecting procedures, in four different processing plants with highly processed products, 1009 microorganisms were isolated by classical methods (from agar plates) and identified. Microbial contamination of fish appears as a result of the attacks on fish by undesirable microorganisms (bacteria, mold, fungi, virus or their toxins and by-products) from external sources. Temperature and pH are limitation parameters for the survival and growth of bacteria in fish products. Pathogens such as *Salmonella* spp., *Yersinia* spp., *E. coli*, and *Listeria monocytogenes* are responsible for important foodborne outbreaks worldwide. In this paper is presented information about on the on maximum, cumulative time and internal temperature combinations for exposure of fish and fishery products that, under ordinary circumstances, to assure safer conditions against bacterial pathogens that are of greatest concern in seafood processing. Contamination of the natural environment of fish can affect humans' health because fish and fish products may be a potential source of pathogenic bacteria. Good Hygienic Practice is a measure to avoid contamination and to ensure the safety of fish and fish products.

**Keywords:** commensal microflora, microbial spoilage, *Clostridium botulinum*, *Vibrio parahaemolyticus*, *Salmonella* spp.

**PRELIMINARY RESULTS ON THE PROTECTIVE ROLE OF  
PROBIOTICS ADMINISTRATION IN CASE OF ZINC CHLORIDE  
INTOXICATION IN ZEBRAFISH BEHAVIOUR**

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The purpose of this study was to induce zinc intoxication in zebrafish in order to assess the possible beneficial effects of probiotics. In this experiment we evaluated the acute effects of zinc chloride exposure (96 h) induced at 0,5 mg/L and at 1 mg/L, and subsequently the effects of chronic probiotic exposure (7 days) on the sociability and short-term memory of adult zebrafish using Sociability Test and Free-swimming Test in a T maze labyrinth and EthoVision XT 11.5 software (Noldus, Netherlands). The results obtained showed that the lower concentration of ZnCl<sub>2</sub> reduced the social behavior; this can be related to an underlying possible anxiety mechanism. Meanwhile, at the bigger concentration that effect wasn't as obvious. Furthermore, the zinc at 1 mg/L concentration followed by the probiotic's exposure induced an increased social behavior to the fish, more pronounced than the probiotics alone. These results prove to show the anxiogenic effect of zinc intoxication and the possible benefits of probiotics on zebrafish social behavior. The results of the short-term memory test showed memory impairment both at the lower and at the higher concentration of zinc with little to no improvement after the probiotics. The experiment contributes to the research towards the multitude of health benefits of including probiotics in daily diet.

**Keywords:** zinc chloride, probiotics, *Zebrafish*, behaviour

**THE EFFECT OF SOME NUTRACEUTICALS ON THE BLOOD  
BIOCHEMISTRY AND OXIDATIVE STRESS AT *OREOCHROMIS*  
*NILOTICUS* SPECIES**

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The purpose of this research was to evaluate the effect of fish feed supplemented with some nutraceuticals on the blood biochemistry and oxidative stress of Nile tilapia reared in a recirculating aquaculture system. The experiment was made in duplicate for four weeks and the experimental variants were: V1–control variant, V2–chili pepper, V3–black pepper, V4–onion, V5–goji berries and V6–basil. The nutraceuticals were administered in 1% concentration/kg feed (from V2 to V6 variant). In each experimental variant were used 40 fish with an initial average weight of 100.26±12.19g. In terms of blood biochemistry, the analyzed indicators were: glucose concentration, cortisol, total protein and lysozyme. The biochemical analysis of the blood showed that goji berries (V5) led to the reduction of glucose concentration, supplementing the diet with goji berries (V5), onion (V4), chili pepper (V2) and black pepper (V3) helped to maintain the concentration of total protein in the serum within optimal range and the supplementation with basil (V6) led to the intensification of the lysozyme activity. The oxidative stress analysis involved the determination of the lipid peroxidation index (MDA–nmol/mL) and the total antioxidant capacity (TAC–mM Trolox) in the blood plasma, muscle tissue, liver and gut of the Nile tilapia, as well as the determination of the reduced glutathione

(GSH- $\mu$ mol/dL) from the fish blood. This study highlighted, based on the results obtained in the case of the determination of malondialdehyde and the total antioxidant capacity in blood plasma, liver, muscle tissue and gut, the fact that the nutraceuticals as chili (V2) and black pepper (V3), but also the basil (V6) and goji fruits (V5) led to the reduction of oxidative stress in fish. However, the results of the blood concentration of reduced glutathione obtained in the V4 variant show us that the onion could have the property of reducing the oxidation process at the cellular level if it were administered for a period longer than four weeks. In conclusion, the results showed that the administration of these nutraceuticals in the Nile tilapia diet led to the improvement of the physiological status of fish.

**Keywords:** blood biochemistry, nutraceuticals, *Oreochromis niloticus*, oxidative stress

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**AQUAPONIC PRODUCTION OF KALE (*BRASSICA OLERACEA*  
*ACEPHALA`NERO DI TOSCANA`*)**

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Aquaponics, an innovative and sustainable agricultural approach, combines aquaculture and hydroponics to create a closed-loop ecosystem where fish waste provides nutrients for plant growth. This study aimed to evaluate the growth and productivity of kale (*Brassica Oleracea* var. *Acephala*) cultivated in an aquaponic system using *Carassius auratus* (variety Black Moor) as the fish species. Four different kale stocking densities were tested: 14 plants×m<sup>-2</sup>, 21 plants×m<sup>-2</sup>, 28 plants×m<sup>-2</sup>, and 41 plants×m<sup>-2</sup>. The fish were stocked at a density of 4.6 kg/m<sup>-2</sup> in all experimental units. Throughout the trial period, various growth parameters, including plant height, leaf area, and biomass production, was calculated. Results showed significant differences in kale growth among the tested stocking densities. Kale cultivated at a density of 28 plants×m<sup>-2</sup> exhibited the highest productivity, with increased biomass and overall vigorous growth. Additionally, the aquaponic system proved to be an efficient and sustainable method for cultivating kale, utilizing fish waste as a valuable nutrient source.

**Keywords:** aquaponics, kale productivity, *Carassius auratus*

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## THE PRODUCTION OF *PORPHYRIDIDIUM PURPUREUM* IN AN AIRLIFT FLAT PANEL PHOTOBIOREACTOR

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The production of microalgae has gained an increased attention from the academic community, as well as from the industrial sector, due to their potential to generate high biomasses with increased concentrations of bioactive compounds such as lipids, proteins, polysaccharides and pigments. A variety of microalgae strains have been successfully produced on a large scale such as *Spirulina sp.* and *Chlorella sp.* New species are emerging as potential candidates for commercial exploitation such as *Porphyridium sp.* due to their high content of endo- and exo-polysaccharides. Thus, the present study aimed to evaluate the growth performance of *Porphyridium purpureum* in an airlift flat panel photobioreactor (6 L volume). The microalgal cells were produced in a batch cultivation system and the experimental period extended over a period of 11 days. Light regime was maintained at  $600 \mu\text{mol m}^{-2} \text{s}^{-1}$  and pH of the culture media at 7.5 units. Daily measurements were conducted such as dissolved oxygen and nitrate concentration in the culture media, dry biomass and pigments (total chlorophyll and carotenoids). Nitrate concentration in the culture media decreased gradually from 312 mg/L at the beginning of the experiment to 163.5 mg/L at the end of the experiment. The maximum content of algae biomass in pigments was manifested in the stationary phase (5.20  $\mu\text{g/ml chl-t}$  and 1.32  $\mu\text{g/ml}$ ). The maximum biomass concentration was recorded at 1.27 g/L. The present study demonstrates the feasibility of *Porphyridium purpureum* cultivation in photobioreactors. Nevertheless, further investigation is needed in order to optimize growth conditions and to generate higher yields.

**Keywords:** porphyridium, photobioreactor, pigments, biomass

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## PHYTOPLANKTONIC DIVERSITY IN THE AQUATIC ECOSYSTEM - LAKE PARCHEȘ

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One of the most important organisms for life in the aquatic environment is phytoplankton. They are important for the development of ecosystems and biodiversity because they are primary producers. The purpose of this study is to provide an overview of phytoplankton composition in support of determining phytoplankton diversity. The phytoplankton samples were collected at the end of September 2021, during the autumn period from the Parcheș Lake aquatic ecosystem, Tulcea county. The sampling of biological samples was done from 4 sampling stations, marked S1, S2, S3 and S4, stations that tried to capture the heterogeneity of the species.

Through the qualitative processing of the phytoplankton samples taken from the water surface (about 0.5 m thick), the presence of four taxonomic groups was highlighted, namely: *Baccilariophyceae*, *Euglenophyceae*, *Chlorophyceae* and *Cyanophytes*. A total of 56 species were identified. From the point of view of relative abundance, diatoms dominated in phytoplankton samples in all sampling stations. The highest relative abundance was of *Bacillariophyceae* (52-69%), followed by *Chlorophyceae* (14-28%), *Euglenophyceae* (9-14%). *Cyanophytes* had the lowest abundance between 0-10%.

Diversity is a central concept to ecology, and its measurement is central to any study of ecosystem health. Diversity is a functional and structural parameter of ecosystems, a descriptor for their state of health. The Gini-Simpson index, which is simply the 1-Simpson index and which increases with the increase in species richness of the community, had the highest value in Station S1 of 0.9430 and the lowest value in Station S2 of 0.8863. A more balanced estimate of diversity is provided by the Shannon-Wiener index. The index is derived from information theory and represents the uncertainty with which we can predict which species a randomly chosen individual in the community will be. It had values between 2.6006 in Station S2 and 3.15688 in Station S2. Species composition plays a key role in ecosystem functioning. These results obtained in all 4 stations suggest that the phytoplanktonic diversity in the lake parches aquatic ecosystem is good.

**Keywords:** phytoplankton, Parcheș lake, diversity

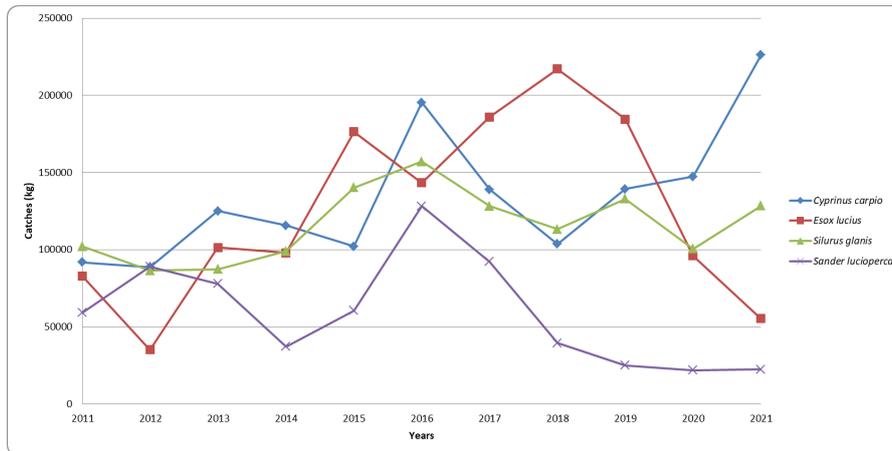
**THE DYNAMICS OF THE FISH CATCHES WITH HIGH ECONOMIC VALUE FROM THE DANUBE DELTA, DURING THE PERIOD 2011-2021**

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Common carp (*Cyprinus carpio*), catfish (*Silurus glanis*), pike perch (*Sander lucioperca*) and pike (*Esox lucius*) are fish species with high economic value from the Danube Delta. These species have played a crucial role in supporting local economies and providing valuable income from commercial fishing. Despite their importance, the populations have been facing challenges in recent years. Overfishing, poaching, and the impacts of current climate changes are among the primary factors contributing to the continuous decline in fish catches. In this context, through an extensive analysis of fishery data and catch reports this study provides insights into the trends and fluctuations of common carp, catfish, pike perch, and pike catches during the period 2011-2021. From the data analysis, it can be observed that there is a downward trend in the catches of pike and pike perch, while the catches of common carp and catfish have shown a slight upward trend (Figure 1). Understanding these dynamics is crucial for effective fisheries management, conservation efforts, and the sustainable use of these valuable fish stocks. The findings presented in this paper highlight the urgency of implementing adaptive management strategies to address the decline in fish populations. The study underscores the importance of collaborative efforts among stakeholders, and local communities to develop sustainable fishing practices, combat poaching, and mitigate the impacts of climate change on the aquatic ecosystem.



**Figure 1.** Catches of *Cyprinus carpio*, *Esox lucius*, *Silurus glanis* and *Sander lucioperca* during the 2011-2021

**Keywords:** overfishing, climate change, fish stock assessment, commercial fishing

**Acknowledgment:** The principal authors want to thanks to the project: “Evaluation studies of live aquatic resources to determine the total allowable catches for each species and in areas of RBDD (lake complex from RBDD, the Danube and its arms, and the Black Sea)”.

**ANALYTICAL FRAMEWORK BASED ON MACHINE LEARNING  
PREDICTION MODELING FOR SUPPORTING THE INLAND  
AQUACULTURE PRODUCTION DECISION PROCESS IN  
ROMANIA VS. V4 GROUP**

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The aquaculture industry has been rapidly growing in recent years and an upward trend is expected to be recorded, also, in the near future. The European Union's desideratum for maximizing the sustainability of the blue economy generates the necessity of adopting optimum decisions in various production and scenarios market value and production planning scenarios. Since aquaculture has different peculiarities in the Eastern part of the EU, compared to Western EU countries, due to the heritage, in terms of both fish production systems and consumers' preferences for certain fish species, as well as the differences between the purchasing power parity, it is important to generate a regional analytical framework which will offer support, to the decision-makers, in adopting production management. The present research aims to develop an analytical framework based on machine learning prediction modelling for supporting the aquaculture production decision process in Romania, in relation to Visegrad geopolitical group (V4), and for identifying if

Eastern EU countries can merge towards a common aquaculture development goal by using similar tools for production management optimization. The database used for developing the analytical framework contains 46 indicators associated with 1334 data inputs (no null values).

A mixed methodology of machine learning-based techniques supervised algorithms such as multiple-linear regressions (MLR), XGBoost and Random Forrest (RF) algorithms were used to establish a high-accuracy prediction framework to better explain the aquaculture-based blue economy mechanism. The results indicate that common carp can be an important tool for predicting both inland water aquaculture production and production value in Romania and V4. Also, fish products exports, and imports, as well as fish consumption and protein and fat consumption from fish products can be successfully used as predictors for increasing the accuracy of the aquaculture production models, in the case of both Romania and V4. In conclusion, the analytical frameworks prove high merging compatibility for the inland aquaculture industry in terms of adopting common tools for achieving the EU goal of increasing the blue economy.

**Keywords:** aquaculture, Romania, V4, machine learning, modeling

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## QUALITY OF FISHERY PRODUCTS IN RELATION WITH METALS IN THE AQUATIC ENVIRONMENT AND ACCUMULATION PROCESSES

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Currently, the polyfunctional role of microelements in the metabolic processes of ichthyofauna (respiration, hematopoiesis, digestion, multiplication, increase or decrease of growth intensity resistance) is unanimously recognized, being also an indicator of the quality of fish products. Thus, knowledge of the legalities of the action of chemical elements on the modification of intensity and direction of biosynthesis processes is not only of scientific importance, but also offers great possibilities in using microelements for a targeted action on different aspects of metabolic processes, optimizing their content in fish, especially in case of their artificial reproduction. Ecological technologies for fish breeding involve the creation of ecological habitat conditions and quality food, including live nutrition such as aquatic invertebrates, algae and microorganisms, which are macro-concentrators of metals in the aquatic environment. The experimental investigations allowed the elaboration and implementation of the use of microelements-metals to increase the viability of fish in early ontogenesis, to increase the nutritional base in ponds, confirmed and protected by patents and which has essentially improved the technology of artificial fish breeding and served as an essential support in the development of fish farming. The processes of metal accumulation in the body of fish are rather uneven, being directed both by the biological properties of fish species (age, type of nutrition, growth intensity, spawning period, etc.), chemical-biological properties of metals, the state of the aquatic environment and the feed composition. By using ICP-OES and AAS techniques for metals quantification, increased concentrations have been established in areas of wastewater pollution, runoff from agricultural land, urbanized areas and aquatic accumulations of thermal power plants. It is also worth mentioning the redistribution of metals between different organs of fish in dependence on the intensity of growth and reproduction processes and fish health state. The highest concentrations of metals are recorded in the skin, liver and gills of fish, but sometimes also in the gonads at stages II-III of development. In the white muscles and eggs of fish, before laying spawning, the lowest concentrations of investigated metals were recorded.

**Keywords:** fish products, metals, aquatic environment

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## COMMERCIAL VALUE OF ORNAMENTAL CARP

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Who would be willing to spend \$1.8 million on a single fish? It may sound astonishing, but this extraordinary sum was actually paid for a particular ornamental carp (*Cyprinus carpio* - var. koi) during the 2017 All Japan Koi Show. In Romania, the popularity of ornamental carp is steadily growing, especially with the increasing number of villas and ornamental ponds. While most koi fish don't command such exorbitant prices, their value can range from as low as \$10 to hundreds of thousands of dollars. The pricing of ornamental carp is influenced by a myriad of factors, including the producer, variety, size, color, sex, difficulty of reproduction, and pattern. The price of koi carp can vary considerably based on a price chart set by retailers and suppliers. Factors such as the country of origin, the quality of the breed, availability, and demand all play a role. The most expensive koi types are typically imported from Japan, originating from rare genetic lines and exclusively bred by top Japanese breeders. Raising koi carp demands a deep understanding of aquaculture and substantial investments compared to typical ornamental carp. It necessitates specialized breeding hatcheries, summer pools for maturing carp, and facilities capable of producing high-quality carp. Artificial reproduction is essential to carefully select breeding stock. These considerations underscore the significance of taking ornamental fish production seriously in dedicated farms. This paper offers a comprehensive review of relevant literature and highlights the significant potential for implementing these carp varieties within Romania's aquaculture industry.

**Keywords:** koi carp, value, varieties.

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