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Food connects people and shares science in a resilient world

Book of Abstracts

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FOREWORD

The International Euro-Aliment Symposium is organized every two years by the Faculty of Food Science and Engineering from the Dunărea de Jos University of Galați, reaching its 10th edition. It provides an excellent opportunity to set up a new perspective and goals for the national and international food academics and stakeholders.

The Euro-Aliment 2021 is committed to function as the best environment for the food scientists, researchers, engineers, technologists, policymakers and businesses in the food and food-related fields, to connect and collaborate to shape new and emerging technological solutions for the development of food industry adapted to the ongoing pandemic crisis. Thus, in a distancing world, Euro-Aliment 2021 also aims to connect people better, share science through food, and identify strategies for an eco-resilient world.

Food science, food technology and related fields such as biotechnology, nutrition, bioeconomy etc. proved to 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 next to food, alleviating their uncertainties and un-trust in a turbulent ongoing and post-pandemic 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 2021 organizing committee expresses its gratitude to all food chain stakeholders, from farmers to marketing and serving, for providing the same diversity of food during the pandemic, as before it.

The Organizing Committee of Euro-Aliment 2021 Symposium

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PLENARY SESSION

PROTEIN-POLYSACCHARIDE INTERACTIONS FOR THE FABRICATION OF BIOACTIVE-LOADED NANOCARRIERS; CHEMICAL CONJUGATES VERSUS PHYSICAL COMPLEXES

Hadis Rostamabadi[1], Seid Mahdi Jafari[2]*

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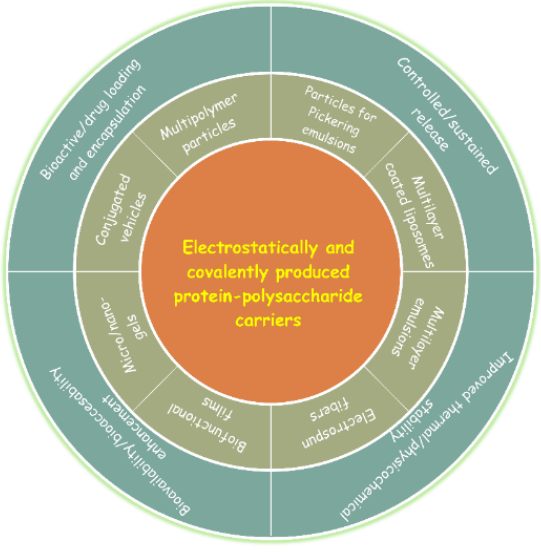
The necessity for development of novel and effective food/drug formulations using diverse bioactives/therapeutics has induced the engineering of biopolymeric vehicles to enhance the bioactive health-promotional outcomes and reduce their undesirable side effects. While numerous food/pharma researches have been focused on bioactive delivery systems designed by synthetic polymers, their restrictions in the background of chemistry, bulk hydrolysis, tunable control of configuration/mechanics, poor aqueous processing, and generation of acidic byproducts have attracted more attention toward nature-inspired biopolymers, especially proteins and polysaccharides. As unique biopolymeric architectures, covalently and electrostatically protein-polysaccharide (PRO-POL) systems can be utilized for bioactive delivery by virtue of their featured structures and unique physicochemical attributes.



These systems possess a number of outstanding attributes, e.g., biocompatibility, biodegradability, and bioavailability with low toxicity that qualify them as powerful

agents for the delivery of different bioactive ingredients. To take benefits from these systems, an in depth understanding of the chemical conjugates and physical complexes of the PRO-POL systems is crucial. Here, we offer a comprehensive study concerning the unique properties of covalently/electrostatically PRO-POL systems and introduce emerging platforms to fabricate relevant nanocarriers (i. e., microscopic/nano-dimensional multi-polymer particles, molecularly conjugated vehicles, electrostatically complexed systems, hydrogels/nanogels/ oleogels/emulgels, biofunctional films and fibers, multilayer emulsion-based delivery systems, particles for stabilizing Pickering emulsions, multilayer coated liposomal nanocarriers and biopolymer-incorporated liposomes) for encapsulation of bioactive components along with a subsequent sustained/controlled release.

Keywords: Millard conjugation, electrostatic complexation, proteins, polysaccharides, delivery systems

ENCAPSULATED FOOD PRODUCTS AS A NOVEL IMMUNITY BOOSTER AND COVID-19: TRENDS AND TECHNOLOGICAL DEVELOPMENT

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In December 2019, the SARS CoV-2 - a novel coronavirus was identified which quickly distributed to more than 100 countries around the world. There are currently no approved treatments available but only a few preventive measures are available. Among them, maintaining strong immunity through the intake of functional foods is a sustainable solution to resist the virus attack. For this, bioactive compounds (BACs) are delivered safely inside the body through encapsulated food items.

Encapsulated food products have benefits such as high-stability and bioavailability, sustained release of functional compounds, inhibit the undesired interaction, and high antimicrobial and antioxidant activity. Several BACs such as ω-3 fatty acid, curcumin, vitamins, essential oils, antimicrobials, and probiotic bacteria can be encapsulated which exhibit immunological activity through different mechanisms. These encapsulated compounds can be recommended for use by various researchers, scientists, and industrial peoples to develop functional foods that can improve immunity to withstand the COVID-19 outbreak in future.

Encapsulated BACs, upon incorporation into food, offer an increased functionality and facilitate their potential use as immunity booster. Being a scientist and food science and technology expert, we must aim to target various encapsulated food products and their role in improving the immunity system. The bioactive components like antioxidants, minerals, vitamins, polyphenols, omega (ω)-3 fatty acids, lycopene, probiotics, etc. which boost the immunity and may be a potential measure to prevent COVID-19 outbreak were comprehensively discussed. This article also highlights the potential mechanisms; a BAC undergoes, to improve the immune system.

Keywords: Bioactive compounds; Curcumin; Probiotics; COVID-19; SARS CoV-2; Encapsulated Food; Human immune system; Immunological activity

PROBIOSENIOR PROJECT: ELDERLY PEOPLE AS A TARGET POPULATION FOR PROBIOTIC SUPPLEMENTATION AND FUNCTIONAL FOOD

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Europe and Italy are facing an ageing population. This long-term process is transforming the demographic, social and economic facets of societies. It is estimated that the segment of people aged 65 and older will grow from 19.7% to 29.5% of the total EU population, between 2018 and 2060, with an even greater increase of people over 80 years, who will double (from 6% to 12%) in the same period. The concepts of active and healthy ageing are evidenced by promoting new perspectives on aging individuals and later life. Diet and supplementation are also of primary importance in prevention and treatment of age-related diseases and conditions.

PROBIOSENIOR project is a double-blind, randomized, placebo-controlled study. The rationale of the study design is based on comparing the efficacy of a probiotic dietary approach with functional foods and/or dietary supplements, in the reduction of low-grade inflammation, by improving the intestinal functionality and the composition of the gut microbiota in healthy elderly free-living volunteers or living in six boarding homes. Six different food products were used as carriers for

delivering probiotic bacterial strains: yoghurt, fruit smoothies, mozzarella, ricotta and primo sale cheese, chocolate, all provided by local food makers. In addition, SYNBIO® capsules (Synbiotec Srl, Camerino, Italy) were also provided to the people as probiotic supplement. The plasma concentration of high sensitivity C-reactive protein was selected as a primary outcome, because internationally recognized as marker of low-grade inflammation and cardiovascular risk. Secondary outcomes as gut microbiota composition, short chain fatty acids and biogenic amines level, circulating factors and immunological components were also investigated.

Some changes in the gut microbiota and metabolites, and in the circulating factors, were registered. A logistic platform and smart box were also validated for the management and delivery of probiotic functional foods to institutions and private houses, outlining a new approach for monitoring the subject compliance.

Keywords: probiotics, SYNBIO®, C-reactive protein, gut microbiota, bacterial metabolites

Acknowledgment: The project PROBIOSENIOR was granted by POR FESR 2014-2020, Marche Region, Italy.

FREE AND ENCAPSULATED ESSENTIAL OILS AS NATURAL FOOD PRESERVATIVES

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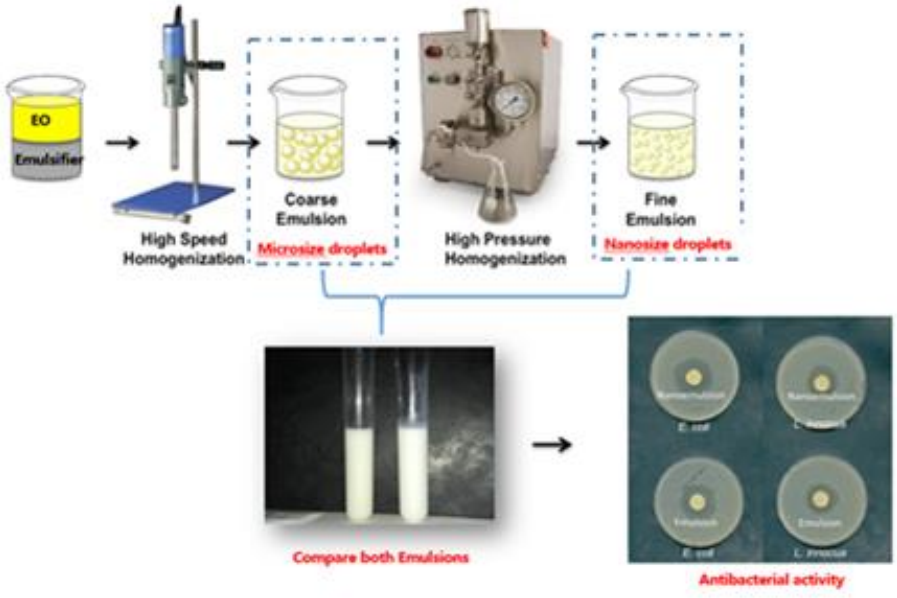
The global demand for safe and healthy food with minimal synthetic preservatives is continuously increasing. Natural food antimicrobials and especially essential oils (EOs) possess strong antimicrobial activities that could play a remarkable role as a novel source of food preservatives. Despite the excellent efficacy of EOs, they have not been widely used in the food industry due to some major intrinsic barriers, such as low water solubility, bioavailability, volatility, and stability in food systems. Recent advances in nanotechnology have the potential to address these existing barriers in order to use EOs as preservatives in food systems at low doses. Thus, in this presentation, we explored the latest advances of using natural actives as antimicrobial agents and the different strategies for encapsulation used for this purpose.



The state of the art concerning the antibacterial properties of EOs will be summarized, and the main latest applications of free and encapsulated antimicrobial agents in food systems will be presented. In fact, before using these natural bacteriostatic agents for food preservation, the following challenges need to be

properly addressed: (i) a better understanding of the mechanisms of action of natural antimicrobials is necessary to provide a solid foundation for engineering new antimicrobial systems and strategies; (ii) costs should be carefully evaluated, because the use of some natural antimicrobial agents is still expensive, as well as the production of capsules; and (iii) future research must address the synthesis of new synergistic formulations based on EOs and their encapsulation, to reduce their adverse effects on sensory properties and improve their antimicrobial efficacy in food matrices.

Keywords: essential oils, antimicrobial activity, nanoencapsulation, food preservation

ECO-INTENSIFICATION OF FRESHWATER AQUACULTURE TO ASSURE OPTIMAL GROWTH, SURVIVAL, HEALTH, AND WELFARE OF FISH WITHIN EXISTING FARM FOOTPRINTS

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Aquaculture is a key food production sector globally and a considerable part of this production was represented by freshwater aquaculture (51.3 Mt, 62.5%), of which 47 Mt (91.5%) consisted of finfish production. Farmed freshwater fish make important contributions to food and nutrition security and, to some extent, try to address global concerns stated in the Sustainable Development Goals (SDGs). The report State of World Fisheries and Aquaculture (SOFIA) forecast that by 2030, freshwater production of finfish will reach 60% of global aquaculture production. However, this trend will be possible mainly due to eco-intensification rather than horizontal expansion, i.e. increase of production per unit land and water within existing farm footprints. Eco-intensification of freshwater aquaculture is a transdisciplinary challenge that requires the integration of scientific and technical innovations, among others, to improve the management of farms, in terms of food conversion rate (FCR), fish performance and reduction of wastes, through the use of sensors, biomarkers, Big Data, IoT (Internet of Things) and predictive mathematical models. To assess whether novel feed formulations are viable solutions for a certain fish culture all must be assessed by a set of key performance indicators (KPI), i.e. growth efficiency (weight gain, feed intake), resource utilization (feed conversion ratio), health and welfare issues (mortalities, enteritis) and, in market-size fish, quality (fillet yield, taste). Along with the production schemes farms need to implement procedures to turn common by-streams (mortalities, sludge, wastewaters) into a valuable product and increases profitability of the farm in a sustainable and cost-effective way. Additionally, all the aspects can be co-managed within an approach called precision aquaculture that is founded on a set of disparate, interconnected sensors deployed in aquatic environments to monitor, analyse, interpret, and provide decision support for farm operations. To ensure the achievement of the specific objectives farmers must address current barriers (e.g. regional and national policy) to the implementation of the principles of circular economy in aquatic production.

Keywords: aquatic food, circular economy, Big Data, biomarkers, sustainable aquaculture.

Acknowledgment: The talk is based on the results from the EU Horizon2020 project GAIN. This project has received funding from the European Union's Horizon 2020 funding programme, Grant Agreement no. 773330 (GAIN).

FRUIT AND VEGETABLE PROCESSING WASTE AS NEW RAWS

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Currently, there is a growing interest for developing environmentally friendly processes in various industry branches. Moreover, these trends are strongly influenced by consumers. Seeking for green solutions is a subject that takes up a lot of space in many areas including fruit and vegetable processing industry. This presentation will provide the latest information on recent developments and applications of sustainable approaches for byproducts reusage as valuable raw materials.

Keywords: sustainable approaches, fruit and vegetable waste, supercritical fluid extraction, bioproducts

USEFULNESS OF NATURAL PROTEOLYTIC ENZYMES OF FISH BY-PRODUCTS FOR NEW PRODUCTS OBTAINING

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Fish industry is generating huge amounts of by-products. Enzymes are often used to reintegrate some fish processing by-products into valuable products.

Isolated proteolytic enzymes are usually added in the process of protein hydrolysis products recovery from by-products after fish filleting. The resulting hydrolysates are rich in bioactive peptides, especially of antioxidant properties. Isolates and hydrolysates added to fish meat products positively influence their yield and nutritional value.

However, the natural proteolytic enzymes could also be used to obtain valuable products in many cases and to improve economic and environmental effects. In case of small pelagic fish like sprat the high activity of digestive enzymes in some seasons is usually the cause of quality losses. Fish harvested as bycatch in spring, when the content of fat is low and therefore the technological suitability is low, showing high proteolytic activity, especially after freezing and thawing. The appropriate processing of whole fish with high addition of salt leads to obtain fish sauces and protein hydrolysates with high antioxidant activities.

One of the biggest problems in fish industry are brines obtained after fish salting and marinating. They usually contain high amounts of salt and organic acids, but they also contain protein hydrolysis products, enzymes and fish lipids. The reuse of brines reduces costs of the production and allows to obtain new valuable products. The method discovered in West Pomeranian University of Technology in Szczecin is used to obtain ripening marinades from fish species that do not ripen in fresh brines.

Keywords: by-products, enzymes, fish

TRENDS AND DRIVERS IN FOOD SCIENCE, TECHNOLOGY, AND NUTRITION IN A RESILIENT WORLD SESSION

CURRENT TRENDS IN SPRAY DRYING TO ENHANCE PROCESS PERFORMANCE AND POWDERS PROPERTIES

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The history of spray drying (SD) dates back to the end of the XIX century. In the case of many products, the process is widely recognized and does not create problems, while many others are still waiting for new design and technological solutions to reduce energy consumption, enhance the process flow and improve properties of obtained products. Since early development the spray drying system has evolved in its construction, and currently there are numerous system modifications already available in the market, apart from other being on early implementation or laboratory stage. The aim of presentation is to show briefly the background of spray drying, already implemented solutions and to present the description of less developed approaches. The evolution in spray dying technology is multidirectional and aims to overcome different drawbacks of conventional spray drying system. The main drawbacks are identified as: high temperature/thermal degradation, stickiness due to low T_g, poor physical properties of powders, difficult atomization of concentrated materials, viscosity limitation, high energy consumption, low thermal efficiency. The new innovative approaches developed to overcome the problems will be presented, including: multistage SD, dehumidified air-assisted SD, foam SD, flame SD, pulse combustion SD, ultrasound-assisted SD, nano SD, SD equipped with in-line separators of powder particles.

Keywords: spray drying, carriers, dehumidified air, ultrasound, nanotechnology

ALTERNATIVE FLOURS FOR GLUTEN-FREE BREAD: THE CASE OF ACORN

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Celiac disease and the increasing number of consumers suffering from this immune response disease represent a major challenge for the food industry. To these persons it is recommended a strict diet that avoids the consumption of wheat and other cereals that contain gluten (i.e. rye, barley) as well as all their derived products. The food industry is focusing on the production of gluten-free products (GFP) made from alternative raw materials that not only need to fulfill the increasing number of consumers demanding GFP but they also aim to improve the nutritional profile and quality characteristics of these products.

Bakery products and especially bread occupies a special place in the daily menu of consumers. Gluten-free breads may differ greatly depending on the ingredients used to replace gluten containing flours. Although one can find different ready-to-use gluten-free mixtures, there is observed that the final products are inferior to the respective conventional not only with regard to texture but also in terms of their nutritional characteristics.

Acorn flour represents a promising source of flour to be used in gluten-free breadmaking due to high levels of lipids, fibers and phytochemicals (i.e. various sterols and phenolics) it contains. In the literature, there are only a few examples of the utilization of acorn flour for gluten-free bread production. In this work we report our research on alternative gluten free flours, focusing on the breadmaking ability of acorn flour. The effect on dough rheology and microstructure as well as in bread crumb properties, its fine structure and staling phenomena is reported.

Keywords: gluten-free, bread, dough, acorn, antioxidants

ENCAPSULATION OF PLANT BIOACTIVE COMPOUNDS (*CENTELLA ASIATICA*) AS A STRATEGY TO DEVELOP FUNCTIONAL FOODS

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Regular consumption of food and herbal extract as part of a balanced diet displays different functional properties in humans, as per the research. This consumption trend follows the food that has herbal extract with adequate minerals, vitamins, and antioxidants. However, under normal conditions, these components are unstable or exhibit a residual taste, which limited their application. Thus, encapsulation is a technique that can improve the stability of these constituents so that they can be applied in various food matrices. In this work, the ethanolic leaf extract of *Centella asiatica* (CA) was encapsulated in soy lecithin and stigmasterol. The encapsulation efficiency, particle size, and zeta potential of encapsulated CA leaf extract were studied. Also, the storage stability, lipid oxidation, and thermal stability of encapsulated CALE were investigated. The results showed that the CA contains different minerals at higher concentrations. All particles had a negative zeta potential, with a mean size of vesicles ranged from 512.67-787.78 nm. Storage study showed that encapsulation retained the highest amount of total phenolics and antioxidant activity during 21-day storage. Secondary oxidation of lipids is also reduced in CA leaf extract loaded liposome (CALE-LP) than empty liposome. Therefore, as CALE-LP successfully retains the leaf extract's bioactivity for a more extended period, which can be used to develop new fortified food products with health benefits.

Keywords: *Centella asiatica*, encapsulation, storage study, lipid oxidation

QUALITY CHARACTERISTICS OF WHITE BRINED CHEESE PRODUCED FROM GOAT MILK WITH DIFFERENT SOMATIC CELL COUNT

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This experimental work aimed to investigate the quality characteristics of white brined cheese produced from goat milk with different somatic cell count. Goat milk samples were divided into three groups according to the levels of somatic cell count: I group – cheese with low somatic cell content (CL) with about 1 200 000 cells/ml; II group - cheese with high somatic cell content (CH) with about 1 750 000 cells/ml and III group – cheese with medium somatic cell content (CM) with about 1 600 000 cell/ml (CM). White brined cheese was produced from different goat milk categories and was ripened for 45 days. Chemical, microbiological and organoleptic evaluations were performed on the 1st and 45th day of cheese ripening. The obtained results showed that the differences in the composition of goat milk during the different stages of lactation as well as the level of somatic cell count had significant effect ($p < 0.05$) on the chemical composition of the cheese samples. A significant increase ($p < 0.05$) in the cheese active acidity during the ripening period was also observed. It was established that the total lactic acid bacteria count in the experimental samples decreased from 8.2 to 7.9 log cfu/g for CL and CM and to 7.5 log cfu/g for CH at the end of the respectively ripening period. *Coliforms, Listeria monocytogenes, Coagulase-positive Staphylococci* were not detected in the cheese samples. It was found that the psychrotrophic microorganisms and total yeast and molds decreased during ripening period. The organoleptic evaluation demonstrated a higher score for CL and CM samples in comparison with the CH sample.

Keywords: quality, ripening, somatic cell count, white brined cheese

Acknowledgment: This study was carried out with the financial support of the Scientific Investigation Section Project 03/20-H, Science Fund, University of Food Technologies, Plovdiv, Bulgaria.

THE INFLUENCE OF BERRY EXTRACTS ON YOGURT QUALITY

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The yogurt is a food that provides important nutrients consumers of all ages and is part of a balanced diet. The purpose of the research presented is to obtain an assortment of lactic acid products, with increased biological value by adding concentrated hydroalcoholic extracts from sea buckthorn, rosehip and chokeberry fruits. The plant extracts with a dry matter content of 85±1% in a proportion of 1% were added. The evolution of sensory indices and physico-chemical indicators during the storage of fortified yogurt for fifteen days in relation to the control sample was studied. The antioxidant activity (*in vitro*) of yogurt on the eighth day of storage was analyzed. On the first ten days, the sensory characteristics of the tested samples did not change. On the fifteenth day of storage, the rosehip (RY) and chokeberry (CY) yogurts were rated as "good", and the control (CS) and sea buckthorn (SBY) samples were "satisfactory" with poorly defined sensory properties. It was found that SBY can be kept for a maximum of thirteen days, but RY and CY - fifteen days. It was observed that with the intensity of the fermentation process, the acidity of fermented dairy products gradually increases, in the first days being constant, then reaching higher values. During the storage of fifteen days, the acidity of the yogurt samples changed within the following intervals: CS (83 - 110.5°T); SBY (89.5-113.0°T); RY (85.5 - 111.5°T) and CY (84.5 - 110.0°T). Probably, berry extracts stimulate the growth of lactic acid bacteria from yogurt starter culture and as a result the accumulation of lactic acid. It was found that the viscosity values in all samples examined during storage decreased. The lowest viscosity values were determined in RY (725mPa·s). The values of the syneresis index decreased due to the reduction of water retention capacity in tested yogurts. The highest value of the syneresis index was obtained for SBY (66.78%), and the lowest for CY (63.11%). Positive and high values of antioxidant activity were demonstrated in all samples studied, especially in yogurts with extracts, the values of antioxidant activity being arranged in descending order: RY>SBY>CY>CS, presenting an important argument in favor of fortified products. In addition, the increased antioxidant activity values are attributed not only to the phytochemical content of the extracts, but also to the metabolic activity of lactic acid bacteria from the starter culture.

Keywords: yogurt, berry extracts, quality, antioxidant activity

Acknowledgment: The authors would like to thank the Moldova State Project no. 20.80009.5107.09, "Improvement of food quality and safety by biotechnology and food engineering", running at Technical University of Moldova.

INFLUENCE OF ULTRASONICATION ASSISTED EXTRACTION ON THE CONTENT OF BIOACTIVE COMPOUNDS AND ANTIOXIDANT ACTIVITY IN GRAPE MARC EXTRACTS

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Ultrasonication is an efficient technique for extracting intracellular bioactive compounds from the plant matrix. The red grape marc from the "Isabella" variety was used for the research. The influence of the duration of ultrasonication assisted extraction (UAE) of 10 and 60 min and of the extraction temperature 30 and 65°C on the total polyphenol content (TPC), total anthocyanins content (TAC) and antioxidant activity (AA), determined by the DPPH test, in the ethanolic extracts of 60% (v/v) of grape marc. The obtained results attest that the temperature has a pronounced influence on the UAE efficiency on the TPC and TAC in grape marc extracts. It was shown that by increasing the extraction temperature from 30 to 65°C when applying of ultrasound for 10 min, the extraction of the TPC and TAC increased by 10.6% and respectively13.4%. In the case of application of ultrasound for 60 minutes, the extraction yield of polyphenols and anthocyanins increased by 11.9% and 14.3% respectively. The growth in the extraction efficiency of phenolic compounds is due to the production of matrix bonds broken, solubility of phenolic compounds, speed of solvent diffusion and mass transfer increased, reduction of viscosity and solvent surface tension. It was shown that at the extraction temperature of 65°C, increasing the duration of ultrasound application from 10 to 60 min, the TPC and TAC were reduced by 3.7% and respectively by 7.6%. The long duration of ultrasound application has helped to reduce the amount of polyphenolic compounds due to cavitation, which changes of diffusion velocity, accelerating chemical reactions and degradation of enzymes. The highest values of antioxidant activity correspond to the extraction rate of phenolic compounds at the temperature of 65°C and the duration of ultrasound application 10 min, being 16.74 mmol TE/100 g d.w. The accentuated influence of the extraction temperature on the TPC, TAC and AA compared to the duration of ultrasound application was demonstrated.

Keywords: ultrasonication assisted extraction, grape marc extracts, bioactive compounds

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IMPACT OF SEA BUCKTHORN BERRIES (*HIPPOPHAE RHAMNOIDE*) ON YOGHURT BIOLOGICAL VALUE AND QUALITY

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In this research, an integrated physico-chemical and sensory approach was implemented to study the impact of sea buckthorn addition in a fermented dairy product such as yogurt. For this, yogurt samples were prepared with the addition of sea buckthorn puree in different concentrations - 1%, 3%, 5%, 7%. Thus, research has been done to determine the impact of the addition of sea buckthorn on the quality of yogurt. The obtained results demonstrate that fat content, is decreasing from 4.4% for the sample with 1% sea buckthorn to 4.2% for the sample with 7% sea buckthorn, which is caused by the addition of sea buckthorn, which gradually replaces the milk content of the product.

The protein content for all samples meets the requirements of the regulation for dairy products (min. 1.6%), ranging from 3.29% to 2.6%.

During fermentation and storage, the acidity values are increasing and this is most noticeable in samples with the highest sea buckthorn content due to the significant intake of acids from sea buckthorn that speed up the acidification.

It has been shown that sea buckthorn has a positive influence on the number of viable microorganisms, probably due to the presence of factors with prebiotic and nutritional action (oligosaccharides, mineral salts), which stimulate the growth of bacteria.

The determination of yogurt quality indices confirmed the positive role of the introduction of sea buckthorn in yogurt. Following the organoleptic examination, it was deduced that the sample with 5% and 7% added sea buckthorn has favorable characteristics for the consumer, but the latter are to be improved, because they have values of over 35% serum release.

Keywords: sea buckthorn, yoghurt, prebiotics, probiotics

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ENCAPSULATION OF ANTHOCYANINS FROM CORNELIAN CHERRY JUICE BASED ON SOY PROTEINS

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The paper describes two methods for encapsulation of anthocyanins from cornelian cherry fruits juice using soy proteins as the main carrier. The first method consisted in using as encapsulating agents a mixture of soy proteins and pectin following the complex coacervation, whereas, the second used only soy proteins applying the cold gelation procedure. The powders were characterized for their flow properties, retention and encapsulation efficiency, color, microstructure and stability under simulated gastric and intestinal juice. Powder obtained by complex coacervation had an encapsulation efficiency of 97.24±0.43% and 64.65±4.75 % for powder obtained by cold gelation. The flow properties expressed in terms of bulk and tapped density, Carr Index and Hausner Ratio indicated that both powders had excellent flowing properties. The color analysis showed that the powder obtained by complex coacervation had the lowest lightness and the highest red color. After 30 days of storage, the lightness decreased, whereas redness increased indicating anthocyanidins release in both powders. The *in vitro* digestibility results indicated that soy proteins and pectin were able to protect anthocyanins in the gastric phase, the highest release being achieved in intestinal phase. On the other hand, most of the anthocyanins of the powder obtained by cold gelation were released in the gastric digestion step. In conclusion, compared to cold gelation, the complex coacervation using soy proteins and pectin was able to deliver superior characteristics for anthocyanins encapsulation and protection.

Keywords: soy, encapsulation, coacervation, cold gelation, pectin

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IMPACT OF HIGH PRESSURE PROCESSING ON STRUCTURAL AND ANTIGENIC PROPERTIES OF OVALBUMIN AND OVOMUCOID

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In food industry, finding the balance between quality of the final products and microbiological stability is often challenging. In this respect, high pressure processing of different food products and ingredients is an efficient alternative for thermal treatment. In this study, the *in vitro* experiments and *in silico* calculations were combined to investigate the impact of high pressure processing on the structural and antigenic properties of two most important allergen proteins from eggs, namely ovalbumin and ovomucoid. Fluorescence spectroscopy measurements were first performed on proteins solutions preliminary treated for 10 min at different high pressure ranging from 200 to 600 MPa. The intrinsic tryptophan and tyrosine fluorescence intensity of ovalbumin and ovomucoid, respectively, was monitored in the 310-420 nm range, upon exciting at 292 nm and 274 nm. Based on the maximum fluorescence intensity values and the corresponding wavelength it was concluded that the pressurized globular proteins suffered limited structure changes in respect to the native states. Moreover, the results of the sandwich enzyme immunoassay suggested no important alteration of the conformational epitopes. In case of both studied proteins, the highest relative antigenicity reduction, of 4-5%, was observed when processing at 400 MPa. Further single molecule level details on the structure particularities and conformational changes were collected by checking the molecular dynamics of ovalbumin and ovomucoid in solution subjected to high pressure. Regardless of the applied pressure treatment, the globular shape and tight packaging of the proteins was rather well conserved. The amount of amino acids involved in defining the helix motifs was balanced by those organized as strands. Overall, the exposure of the hydrophobic patches accommodating the protein epitopes recognized by the IgE antibodies was not significantly affected by the high pressure treatment. The only exception concerns the Glu^{191}-Val^{200} epitope of ovalbumin which was destabilized because of the alteration of the hydrogen bonding network, resulting in important side chains rearrangements. The *in silico* observations are in good agreement with the experimental results, suggesting that within the investigation range, the high pressure treatment does not significantly alter the structure of main allergen proteins from eggs, in such manner to affect their antigenicity.

Keywords: food allergens, ovalbumin, ovomucoid, high pressure processing, antigenicity

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INFLUENCE OF THE CONTROLLED ATMOSPHERE ON THE QUALITY OF POTATOES WITH RED AND PURPLE FLESH

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The purpose of the present study is to determine and evaluate quality changes of potato tubers with different colored flesh, during storage in controlled atmosphere chambers. The research was conducted in 2018–2019 at Vytautas Magnus University, the Agriculture Academy. The three-factor experiment was performed: *factor A* – tubers of two potato cultivars ('Red Emmalie' with red flesh, 'Violetta' with purple flesh), *factor B* - tuber's storage period (at harvest, after 6, 12 and 18 weeks of storage), *factor C* – different air composition (chamber No. 1: 2 % – oxygen (O_2), 7.5 % – carbon dioxide (CO_2), 90.50 % – nitrogen (N_2), and chamber No. 2: 21 % – O_2, 0.03 % – CO_2, 78.97 % – N_2. Potato tubers were stored at a constant temperature of 6°C and relative humidity – 95%. The potato samples were analysed for: dry matter, soluble solids, nitrates and starch by standard methods. The peel firmness of tuber and natural weight loss were also estimated.

The results show, that during the storage period the lowest dry matter and starch losses were found in the tubers stored in the chamber with 2% O_2, 7.5% CO_2 and 90.50% N_2. The nitrate content decreased during the potato storage period regardless of the air composition. Content of soluble solids increased the most in 'Violetta' tubers stored in the chamber with atmospheric parameters 21% O_2, 0.03% CO_2 and 78.97 % N_2. The peel firmness of 'Violetta' tubers was reduced during the storage period in a chamber with 2% O_2, 7.5% CO_2 and 90.50% N_2. After 18 weeks of storage, the significantly lowest natural weight losses were determined in tubers stored in the chamber whereas O_2 was 2%, CO_2 – 7.5% and N_2 – 90.5%. The greatest weight losses were found in tubers of 'Violetta'.

Based on the present study, the conclusion may be drawn, that potato tubers stored in the chamber with 2% O_2, 7.5% CO_2 and 90.50 % N_2 had the best qualitative parameters.

Keywords: controlled atmosphere chamber, starch, natural weight loss, storage period

QUINCE (*CYDONIA OBLOGNA*) PASTE: FUNCTIONAL INGREDIENT FOR PASTRIES

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The aim of this research is to obtain functional pastry products with quince paste as texture agent.

Modern foods are characterized by deficiencies of essential nutrients (vitamins, minerals), and the current trends of consumers regarding healthy eating, is manifested by the privilege of food products, which in addition to basic nutritional principles, contain biologically active substances with beneficial effects on maintaining health and which could also prevent or reduce the risk of disease.

The paper presents functional pastry preparations with the addition of quince paste, which come to diversify the range of pastries and contribute to increasing the nutritional value of these products due to the rich content of vitamins, dietary fiber, minerals, etc., which are found in quince. The pastries (sunflower oil-based cake, butter-based cake, butter-based cookie) were prepared with the addition of quince paste in concentrations of 30%, 20% for cakes and 25% for cookies.

The analysis of the organoleptic properties showed that the addition of 20% quince paste to wheat flour, improves its appearance, taste, smell and color. The physico-chemical indices (dry matter, antioxidant capacity, polyphenol content, density, number of pcs / kg) of the products with the addition of quince paste also attest to the positive effect of its incorporation in the pastries formulation.

The ability of quince paste pastry to inhibit hydrogen peroxide was investigated. It was found that in all cases the samples with the addition of quince paste show an increased capacity to inhibit hydrogen peroxide (22.9 - 27.6%) compared to the control samples (21.7 - 25.2%). Microbiological analysis of quince paste pastries showed that they can be stored for up to 5 days - for cakes, and up to 45 days for cookies.

Keywords: quince paste, antioxidant capacity, pastry, cakes, cookies

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IMPACT OF USING CHIA FLOUR (*SALVIA HISPANICA* L.) FOR BREAD MANUFACTURING

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The research is based on the use of chia seed (*Salvia hispanica* L.) flour in the manufacture of bread. The advantage of chia flour is the lack of gluten, so it can be used to obtain products for people with gluten intolerance, it has a low-calorie content, a high content of unsaturated fatty acids, vitamins and minerals.

Existing studies demonstrate the physico-chemical composition and nutritional importance of chia seeds (*Salvia hispanica* L.) with a high dietary fiber content. Thus, all this makes it possible to use chia seed flour in order to adjust the composition and properties of confectionery products. Today the flour is obtained by grinding chia seeds, the feasibility of its use in the production of bakery products, is also due to the ease of use and the lack of any further processing.

The research objective was to modify the bread recipe by partially replacing wheat flour with chia seed flour (*Salvia hispanica* L.), developing the technological scheme of the new type of product.

Incorporation of chia seed flour in the bread recipe for 10% not substantially altered the chemical, chemical (acidity, leavening, elasticity, porosity, etc.) and sensory properties of the dough and bread, which allows the diversification of the product ranges of existing bakery on the market.

Keywords: Chia - *Salvia hispanica* L., bread, functional properties, functional foods

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INVESTIGATIONS ON THE FUNCTIONAL PROPERTIES OF BREAD OBTAINED FROM WHEAT-SORGHUM COMPOSITE FLOURS

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Sorghum is part of the so-called coarse category of cereals appreciated for their nutritional and pharmacological properties. Therefore, sorghum flour is often used to improve the content of bioactive compounds of different bakery products obtained from white wheat flour.

The impact of 15, 35 and 55% sorghum flour addition on the rheological behavior of dough obtained from wheat-sorghum composite flour and on the total phenol content and antioxidant activity of dough and bread were analyzed.

The impact of sorghum flour addition on the rheological behavior of wheat flour was evaluated using the Simulator protocol of the Mixolab device. The obtained results showed a decrease of the dough development time from 3 to 1.6 min and an increase of the dough weakening from 0.14 to 0.19 Nm, as the amount of sorghum flour in the composite flour increased. In addition, mixing tolerance index values increased from 0.19 to 0.27 Nm, most probably as a consequence of the contribution of fibers from sorghum flour. The high content of fibers lead to strengthening of the dough during mixing at a constant temperature of 30°C.

Regarding the total phenols content, the results showed the higher content of these compounds in sorghum flour, 205.81 mg ferulic acid equivalent/100 g d.w., compared to 56.76 mg ferulic acid equivalent/100 g d.w. in case of the wheat flour. The antioxidant activity of wheat flour was much lower (DPPH-RSA of 3.35%) compared to that of sorghum flour (DPPH-RSA of 34.67%). This is explained by the high content of phenolic acids and flavonoids in the sorghum flour, compared to the wheat flour. The same differences in the content of total phenolic compounds and antioxidant activity were observed in case of the bread samples.

The obtained results showed that sorghum flour can be successfully used for improving the functional properties of wheat flour bread.

Keywords: composite flour, sorghum, total phenols content, antioxidant activity

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THERMO-MECHANICAL AND BAKING PROPERTIES OF THE QUINOA-RICE COMPOSITE FLOURS

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The nutritional potential of quinoa was exploited in the last years, in the context of the continuously increasing concerns of the consumers regarding their healthy diets. Besides the nutritional advantages, quinoa provides another important advantage being a gluten free grain. Hence the high interests in using the quinoa flour in order to obtain gluten free composite flour that can be used to prepare different bakery products and breakfast cereals.

The aim of this study was to analyze the changes produced on the rheological properties of dough, by incorporation of quinoa flour into the rice flour. Thus, the impact of 25 and 50% quinoa flour addition on the thermo-mechanical properties of dough obtained from rice-quinoa composite flour and on bread quality were evaluated.

The Mixolab results indicated an atypically curve for the quinoa flour, with a rapid increase of consistency up to 2.11 Nm, followed by a rapid decrease in the first 3 min of the test, and a slow decrease in the following 5 min of kneading at 30°C. The obtained result evidenced a greater thermo-mechanical weakening of quinoa proteins compared to the rice.

The addition of quinoa flour in rice flour decreases starch stability of dough composite flour, from 2.28 Nm to 1.76 Nm, probably due the amylase activity of quinoa flour. Starch retrogradation of dough composite flour was improved with quinoa flour addition compared to the rice flour.

The bread prepared with composite flour had improved quality, in terms of specific volume and crumb firmness, compared to the control sample made of rice flour. These improved properties can be explained through the presence in quinoa of some components with active surface that stabilize the bubbles gas in the dough.

The obtained results highlight that quinoa flour is a good source of flour for preparing gluten free bread.

Keywords: quinoa, rice, dough, rheology, gluten free bread

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IMPROVEMENT OF THE RED WINES QUALITY BY USING YEAST DERIVATIVES AS AN ALTERNATIVE TO LEES

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Through current biotechnological processes based on complex thermoenzymatic treatments, a first category of yeast derivatives products can be obtained, such as: inactive yeasts, yeast autolysates and yeast cell walls.

The treatment with oenological products such as yeast derivatives include their use in the form of nutrients administered in must during the prefermentative stage or alcoholic and malolactic fermentations, as well as their use in the post-fermentative stage during maturation, at the stage of assembling or blending some wines or even before bottling.

The aim of this study was to highlight the effect of treatment red wines (Feteasc㠠neagrã variety) with yeast derivatives during alcoholic fermentation on the chromatic characteristics of the wine after 3 months of maturation.

Experimental studies have shown that wines treated with these products based on yeast derivatives are more balanced in terms of composition, more expressive in terms of taste and more evolved in terms of olfactory point of view.

By using the yeast derivatives in a dose of 40 g/ l, the wine is enriched in microbial colloids and nitrogen compounds (amino acids, peptides, low molecular weight proteins) which ensure a significant improvement of the sensory profile but also of its protein stability and even phenolic stability.

Keywords: red grapes, red wines, yeast derivatives, Feteasc㠠neagrã grapes

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STUDIES ON WHITE MUST CLARIFICATION USING ENZYMATIC PREPARATION

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In white winemaking, the addition of pectolytic enzymes is usually practiced in order to clarify the white or rose must. This process is simple, economical and with positive effects on subsequent technological stages (improving filterability, behavior in stabilization treatments) and wine quality.

The main objective of the research was to optimize the white must (Șarbă variety) clarification using enzymatic preparations. The influence of several factors such as the type of must (free run must and press must); type of enzymatic preparations used: grape maceration enzymes and must clarification enzymes; time of enzyme administration; doses of enzymes used were evaluated.

The use of maceration enzymes performed a more advanced extraction of the structural compounds from the skins into the must, and their addition on the grapes allows increasing the contact time between the enzyme and the substrate and therefore to increase the sedimentation and clarification rate of the must.

The results revealed that determination of the optimal time of enzyme administration and the doses should be established taking into account: the type of enzyme preparation (maceration or clarification) and the purpose clarification or improvement of the clarification of the must and the quality of the resulting wines, in which case the use of maceration enzymes is recommended.

Keywords: white grapes, white wines, enzymatic preparation, Șarbă variety grapes

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THE USE OF SPRING HERBS IN MOLDOVAN PEOPLE'S DIET

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In the spring, the body's adaptation to different temperatures puts a lot of pressure on the immune system, the flu is still haunting, and allergies are more common. For these reasons, many of us, with the arrival of spring, may suffer from asthenia, avitaminosis, exhaustion, etc. To avoid these conditions, consumers often opt for the administration of supplements such as vitamins, minerals, and others in the form of capsules, pills - results of the pharmaceutical industry, which do not have the highest level of assimilation. Our ancestors did not have access to such products, yet they could be proud of a longer life expectancy and a stronger immune system, and this is due probably to their diet rich in herbs and raw products.

The benefits of spring herbs have been known for centuries. Many of them have an enormous arsenal of biologically active substances, which are meant to prevent and reduce the risk of certain diseases. The traditional Moldovan cuisine is rich of different herbs which have been used as food ingredients in salads, soups, pies or main courses in fresh or dried forms since ancient times. The most consumed spring herbs are the *Allium* species (*Allium vineale, Allium ursinum and Allium cepa*), *Neetles, Rumex acetosa* and *Rumex patientia* leaves and others. They are excellent sources of vitamins, minerals and other bioactive substances that will help the body feel full of energy and get rid of toxins accumulated during the winter.

The present work presents an overview of some spring herbs in Moldovan cuisine, including wild garlic, chives, neetle, green onions, *Rumex patienctia* and *Rumex acetosa* leves. Studies on these herbs showed that they have a great biological potential (vitamins, polyphenols, organic acids, minerals) that are benefic for human health.

Keywords: spring herbs, diet, vitamins, health.

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FERMENTATION OF COMBINED WHEAT AND CHICKPEAS DOUGH FLOUR: IMPACT FACTORS

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The aim of this study was to investigate the impact of partial substitution of wheat flour with chickpea flour and to investigate the effect of composite wheat and chickpea flour *(Cicer arietinum L.)* on the baking process (especially on dough fermentation), also to investigate the dough technological and rheological properties and consumption indices of obtained products.

Due to the high carbohydrates content, water-soluble vitamins (especially the B-complex), minerals (calcium and iron) the addition of chickpea flour to cereal product (including bread) formulations would essentially improve their nutritional quality. In addition, chickpea proteins are rich in lysine, but poor in sulfur-containing amino acids, and in cereal proteins the situation is reversed. Thus, the combination of cereal proteins with chickpeas would provide a better overall balance of essential amino acids.

The dough fermentation is the process between the end of kneading and the dividing operation, during which, as a result of biochemical, microbiological, physical, and colloidal processes is obtained a large volume, extendable and resistant dough.

Considering the perspective of establishing the opportunity to apply chickpea flour and the relationship with different factors (chickpea flour, salt, sugar and fat) in the dough environment, the dough fermentation process was monitored based on the dynamics of carbon dioxide formation.

The obtained data show that the gas volume produced by doughs from mixed flours is higher (increase up to 40%) and is directly related to the share of chickpea flour. The improvement of the gas-forming capacity is determined, first of all, by the fact that chickpea flour contains a higher amount of sugars than wheat flour. Secondly, chickpea flour is rich in nitrogenous substances, mineral salts, vitamins, which are important elements for nutrition, multiplication and yeast activity.

Keywords: chickpea flour (*Cicer arietinum* L), fermentation, dough, carbon dioxide

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STUDY OF THE IMPACT OF NUTRITIONAL STRATEGIES ON TOXIC FRACTIONS OF GLUTEN

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Celiac disease (MC) is caused by the improper reaction of T-helper lymphocytes to the gluten contained in the food consumed. Multiple studies targeting the immune response to gluten have shown that gliadin, the alcohol-soluble glycoprotein fraction of gluten, is responsible for the adverse reaction to gluten. 4 fractions of prolamine were identified: α-, β-, γ- and ω. Form α is thought to contain the most active epitopes for the immune system and appears to be primarily responsible for toxicity. In MC, nutritional therapy is the only unanimously accepted treatment by the medical community and consists of an absolutely rigorous gluten-free diet, which must be strictly followed for life.

The aim of this paper is to analyze alternative strategies to ensure the nutritional security of people with gluten-related disorders.

To conduct this study, the literature on the PubMed and Crossref search engines was analyzed, using the Prisma flow chart. The results of the study highlighted several alternative therapeutic strategies for ensuring food safety in the gluten-free diet, focused on various areas of research: DNA bioengineering, enzyme therapy, biotechnological methods of food processing etc.

The administration of oral proteases capable of detoxifying ingested gluten and new food fermentation technologies using bacterial-derived endo peptidases are promising strategies, and research on identifying new solutions to reduce gluten toxicity is ongoing.

Keywords: gluten-free diet, celiac disease, nutritional strategies, food security

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LIPID OXIDATION AND BARRIER PROPERTIES OF THE COATED FREEZE-DRIED CHICKEN MEAT WITH GELATIN-CHITOSAN FILM ENRICHED WITH TUNISIAN ROSEMARY (*R. OFFICINALIS* L.) EXTRACT

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The study aimed to evaluate the quality of the coated freeze-dried chicken meat using gelatin-chitosan film enriched with Tunisian rosemary (*R. officinalis* L.; var. *troglodytarum*) extract. The quality was evaluated on the basis of physical and barrier properties, as well as lipid oxidation for coated and uncoated chicken meat. Chicken breast meat was cut into small pieces, pasteurized (2 min, 98°C), and coated with the active film solution. The active gelatin-chitosan (G-CH) film forming solution enriched with different concentrations of rosemary extract (0, 0.5, 1, 1.5, 2%) was prepared before application. The application of the coating solution with or without ultrasonic treatment was conducted. Then the samples were subjected to freezing at -40 °C and freeze-dried for 72 h. The water activity, color, hygroscopic, and rehydration properties of the freeze-dried coated meat were measured. Moreover, the lipid oxidation of the coated vs. uncoated meat was also investigated during a 6 months storage period, expressed as mg malondialdehyde per kg sample (mg MAD/kg of product). Results showed that the coating can form a non-porous surface which resists the exchange of water vapor allowing the decrease in hygroscopicity and the rate of rehydration. Likewise, the reduction in the color change and the level of malondialdehyde (MDA) proved that the active coating allowed a good preservation of the meat samples against lipid oxidation during a storage period. However, the application of the coating with the use of ultrasound treatment did not affect positively on reducing lipid oxidation, and an even higher value was observed in comparison to samples immersed in film forming solutions without ultrasound treatment. It can be concluded that the phenolic compounds incorporated into the film matrix which has antioxidant activity, have migrated to the food to minimize the extent of lipid oxidation.

Keywords: chicken meat, edible film, rosemary extract, lipid oxidation, barrier properties

EFFECT OF ULTRASOUND TREATMENT ON PHYSICAL PROPERTIES OF STRAWBERRIES

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The purpose of the work was to determine the impact of ultrasound on the color, mechanical properties, and microstructure of strawberries. The tests consisted of carrying out the treatment in an ultrasonic bath with a frequency of 21 kHz and a power of 180 and 300 W for 10, 20, 30, 45, and 60 minutes. The mass and temperature changes during ultrasonic treatment as well as dry matter content, color parameters such as L*, a*, b*, and ΔE, maximum force and work were analyzed.

The study showed that the ultrasound pretreatment caused significant changes in the color of fresh strawberry tissue and damaged the material structure. The brightness of the strawberry significantly changed after ultrasound application, especially when longer treatment was used. Moreover, relevant changes in chromatic coordinates a* and b* were also noted. The greater color alterations were observed when 180 W power ultrasound was used. The total color difference showed significant changes in strawberries treated by lower ultrasound power, especially when shorter processing times, up to 30 minutes, were used. The two-factor statistical analysis showed that the changes in the strawberry properties were influenced by the time and applied ultrasound power alike. However, the time of treatment was more important. Furthermore, ultrasounds have caused significant changes in texture parameters. It was observed that the time and power used during the ultrasonic application significantly reduced the value of the maximum force and work. It has been proved that the use of sonication with a power of 300 W for 60 minutes promotes an increase in the temperature of strawberry fruit and could reduce the dry substance content in the tested samples, which resulted in the loss of strawberry hardness and firmness.

Keywords: strawberry, ultrasound treatment, color, texture

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STUDY OF THE OXIDABILITY OF SOME VEGETABLE OILS

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Lipid oxidation is one of the most important processes in the deterioration of lipid-containing foods. Lipid oxidation is a multi-stage process, with a multifactorial determinism, being influenced in foods by chemical structure (richness in unsaturated fatty acids), physical condition (liquid or solid), the presence in one form or another of inorganic oxidants (ions of some metals: Fe^{2+}, Cu^{2+}, Co^{2+}, Mn^{2+}) or organic (hemoglobin, myoglobin), the pre-existence of free radicals, the existence of lipases, the quantity and quality (selectivity) of substances with antioxidant role in food, the way of food processing, the way of packaging and food storage conditions.

A study on the process of forced oxidation of grape seed oils, walnuts and corn in the presence of hydrogen peroxide and Cu (II) ions was realized. The thermo-oxidation of the oil caused a significant decrease in the saponification index, which indicates a significant degree of polymerization and leads to an increase in the viscosity of the studied sunflower oil. To highlight the impact of heat treatments, the analysis was performed by IR spectroscopy and the possible mechanisms of forced oxidation of unsaturated fatty acids under the influence of heat factor were analyzed. It was established that the applied treatment favored both the formation of carbonyl secondary compounds and the simultaneous formation of hydroperoxides and triglycerides containing hydroxylated groups. The accumulation of hydroperoxides and triacylglycerides that have hydroxyl functions have facilitated the course of polymerization reactions, which are to increase the viscosity of the studied thermo-oxidized sunflower oil. Analogous to the forced oxidation of sunflower oil [1], the formation during oxidation of trans-isomers of polyunsaturated acids was attested. The study investigated and identified the minimum concentrations of antioxidants needed to reduce the oxidation of the analysed oils.

Keywords: vegetable oil, thermal oxidation, IR spectroscopy, peroxide index, acidity index

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Reference

1. Rodica Sturza, Druţă Raisa, Covaci Ecaterina, Duca Gheorghe, Subotin Iurie (2020). Mechanisms of sunflower oil transforming into forced thermal oxidation processes. *Journal of Engineering Science*, no.3, Vol. XXVII, p. 239–251. DOI 10.5281/zenodo.3949716

CHALCHONIC PROFILE OF YELLOW FOOD POWDER-FORM PIGMENT, OBTAINED FROM SAFFLOWER PETALS

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The aim of this work was to establish the relationship of yellow compounds in new powder-form food pigment, obtained by our process [Patent MD-1453, BOPI 2020, **8,** 59. *Process for producing dyes from Safflower*]. HPLC system "Shimadzu LC-2030-C 3D Plus" with photodiode array (PDA) detector were used. The separation of the compounds was performed using the C18 type column "Phenomenex" (4.6x150mm, particle size 5µm), gradient elution at 25ºC, with a flow 0.5 mL/min; Phase A – Water, Phase B – Acetonitrile. The UV-Vis spectra were recorded in the range of 200-500nm. Chromatograms were analyzed at wavelengths λ_1 = 340 and λ_2 = 404nm. Five yellow compounds were separated (Figure 1), and identified by UV-Spectra as: Safflomin C (T_R=18.86, 6.9%); Anhydrosafflor Yellow B (T_R=19.59, 5.9%); Hydroxisafflor Yellow A (basic dye, T_R=20.84; 50.4%) Precarthamin (T_R=22.27; 10.1%); Safflor Yellow B (T_R=24.39; 26.7%).

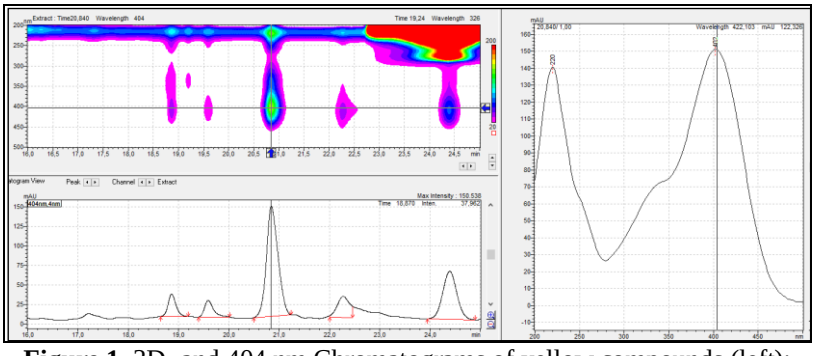

Figure 1. 3D- and 404 nm Chromatograms of yellow compounds (left); UV-Spectra of basic dye, Hydroxisafflor Yellow A (right).

Conclusion: Powder-form yellow pigment (PFYP) contain 5 chalcones, identically with compounds from safflower petals. Thus, in the process of PFYP obtaining, there are no losses of natural chalcones biological activity.

Keywords: Safflower, Natural Yellow Food Pigment, HPLC, Chalcones, Bioactivity

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FERMENTATIVE PROCESSES - FROM TRADITIONAL USES TO CURRENT POSSIBILITIES OF VALORIZATION

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Introduction: Traditional fermented foods are incredibly nutritious and beneficial to health (*functional food*) - being richer in bacteriophages and sanogenic nutrients than their unfermented counterparts, but also with a higher bioavailability.

Aims: Using SCOBY (kefir, kombucha) as a culture medium, the aim is to obtain low molecular weight peptides and structural changes of polyphenols (flavonoids) from processed natural raw materials, under the influence of enzymes produced by bacteria and yeasts during the fermentation process. Also, for obtaining new molecules (postbiotics) with very important functions into the human body.

Results: Maximum nutritional and probiotic values were obtained by fermenting *vegetables, fruits, whole grains, mushrooms and pollen*, achieving the goal of potentiating the natural combinations of enzymes, vitamins and minerals. In addition, fermented foods are an excellent source of prebiotics (cellulose fibers) that can feed useful bacteria from gut (saprophytic flora).

Conclusions: Awareness of the relationship between diet and health at the consumer level corresponds to a greater demand for food promoters of the body's homeostasis, such as functional foods. Of these, sources of probiotics occupy a large market share, generally being added to dairy products (yogurt, fermented milk, cheese), but the consumption of these products is excluded for people with lactose intolerance, for vegans and in diets containing low cholesterol. In this context, fermentation processes can be capitalized in the development of non-dairy products (mushrooms, bee products, vegetables) as food matrices enriched in sanogenic microorganisms. In this approach, the emphasis is on enriching the composition of products with pre-, pro-, post- and para-biotic, by fermentation, without neglecting the technological and sensory aspects.

Keywords: fermentation, dairy, vegetables, mushrooms, pollen

SOME IDENTIFIED BIOLOGICALLY ACTIVE COMPOUNDS FROM THE WALNUT KERNEL'S PELLICLE: WASTES?

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The purpose was to detect substances that cause the gradual blackening of walnut kernels. The polyphenols from kernel's pellicle (walnuts of "Kogălniceanu" variety) were supposed to exhaustive ultrasonically-assisted extraction. For recognition of extracted polyphenols, HPLC system "Agilent 1200" with Single Quadrupole Mass Detector and with Diode Array Detector (DAD), was used. The separation of the extracted compounds was performed on the C18 column "Eclipse XDB", 4.6x150mm, particle size 5µm, using the gradient of the mobile phases **A** and **B** at 25ºC, with a flow rate of 0.5 mL/min. Phase **A**: water with 0.1% acetic acid; Phase **B**: acetonitrile with 0.1% acetic acid. The UV-Vis spectra were recorded in the range of 200-600nm. Chromatograms were analyzed at wavelengths λ_1 = 280nm and λ_2 = 360nm. Phenolic compounds were identified:

R_t, min	λ_{max}, nm	HM^+, m/z	Compound	ω, %
3.44	230	501	2,3-Hexahydroxydiphenaloyl-glucose	17.9 ± 1.1
3.84	230	339	2,3-Hexahydroxydiphenic acid	2.6 ± 0.7
4.50	250	485	Digalloyl-glucose	6.4 ± 2.0
9.63	250	332	Galloyl-glucose	3.6 ± 1.3
11.30	280	579	Procyanidin dimmer	20.5 ± 2.5
12.62	280	291	Catechin	17.2 ± 2.4
13.16	280	291	Epicatechin	8.2 ± 1.4
14.25	250	941, 924	Pentagalloyl glucose	7.9 ± 1.7
14.99	280, 360	936	Casuarictin	8.2 ± 3.0
16.22	280, 360	303	Ellagic acid	7.6 ± 2.1

Conclusion: Biologically active polyphenols have an ambiguous effect on the quality and taste of walnuts. Having worked out their redox potential, they become a source of dark color and bitter taste. Their preventive extraction in an unoxidized state before technological processing can significantly improve the quality of such valuable food "wastes" as walnut cake.

Keywords: walnuts pellicle polyphenols, extraction, HPLC

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WINE WASTE AS A SOURCE OF NON-CONVENTIONAL RESOURCES IN THE FOOD INDUSTRY

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In the Republic of Moldova an average of 270 thousand tons of grapes are processed and by-products which constitute 45-80 thousand tons. They are not fully exploited. The research is focused on the capitalization of phytonutrients from grape seeds in the form of natural food additives. The grape seeds recovered from the fermented pomace of the Muscat variety were dried and finely ground. The physico-chemical indicators of seeds were determined and the properties of the powder were studied in order to apply it to the fortification of bakery products. Recipes are developed for breads with the addition of 3, 7 and 10% grape seed powder. Also the physicochemical characteristics of the raw and auxiliary material are elucidated. The content of total polyphenols in the powder is determined. As a result of testing the nutritional and functional character of finished products. It has been shown that the addition of fine grape seed powder to bread results in an increase in the nutritional value of flour products. It was found that the sample with the addition of 3% seed powder has the highest sensory characteristics: light brown color, pleasant smell and taste. At the same time the sample with 7% seed powder keeps its shape best. As a result of research grape seed powder is recommended for strengthening bakery products. This food additive with antioxidant properties is also a natural preservative, which preserves the taste, color, texture and nutrients, at the same time slows down food spoilage processes, improves the quality, safety and stability of food during storage.

Keywords: winemaking secondary products, grape seeds, phytonutrients, antioxidants, bakery products

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THE IMPACT OF FLAXSEED FLOUR ON THE QUALITY PARAMETERS OF BAKERY PRODUCTS

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Nowadays the demand for functional food products is increasing rapidly. Flaxseed *(Linum usitatissimum)* is used as a potential ingredient for functional food products due to its unique nutrient profile. It contains a lot of polyunsaturated fatty acids (73%), a moderate level of monounsaturated fatty acids (18%) and a low level of saturated fatty acids (9%). The aim of this study was to evaluate the influence of flaxseed flour on the physico-chemical and sensory parameters of the bakery products. Flaxseed flour affects the texture of the dough as well as the bread fermentation during leavening. Was determined that the control sample without flaxseed flour increased its volume by 2.33 times within one hour, as for the sample with 20% flaxseed flour, its volume increased only 1.86 times. The addition of flaxseed flour slows down the dough fermentation process. This fact can be explained by the absence of starch in flaxseed flour, which serves as a nutrient substrate for yeast. Also, there were determined the chromatic parameters of the bread using CIELAB system. It was determined that the color of the crust darkens with the increase of the amount of flaxseed flour used. The porosity for different bread samples was found to decrease, varying from 72,96±0.05% (control sample) to 61.4±0.04% for the sample with 20% of flaxseed flour respectively. Flaxseed flour contains a large number of grain shells, dietary fibers, which are able to compact the structure of the bread crumbs. The high fat content of the dough affects the level of gas formation during fermentation of yeast cells. These factors influenced the porosity decrease of the bread. Analyzing the main sensory parameters was established that samples with the addition of flaxseed flour in different ratios turned out to have a specific flavor, especially the sample with 20% flaxseed flour. The most suitable were the samples with 5% and 10% of flaxseed flour. They were characterized as slightly nutty aftertaste, pleasant texture and flavor. This research demonstrated that the flaxseed flour functional bread is enriched with healthy fats, proteins, with fewer carbohydrates, which is a great advantage for the health of the human body.

Keywords: flaxseed flour, functional food products, functional bakery products.

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EFFECT OF THERMAL PROCESSING ON ANTIOXIDANT ACTIVITY OF LENTIL FLOURS

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Since United Nations General Assembly declared 2016 the International Year of Pulses, the interest of using legumes in various food technologies significantly increased. In order to reduce antinutritive compounds activity, pulses must follow a wet cooking, among which soaking and boiling of whole beans followed by water discard is the most used treatment. Studies revealed that during this type of processing a high quantity of antioxidant compounds is lost with the discarded water. More, the dough for pastry or bakery uses the raw legume flours. For a high legume flour inclusion level (over 40%), using raw flour directly into the dough may result in products with beany and grassy flavors. Thus, thermal pretreatment of legume flours before inclusion into the dough was found to improve sensory acceptance. Taking these into account, the aim of the present study was to observe the effect of thermal pretreatment of lentil flours, followed by oven cooking on *in vitro* antioxidant activity. Total phenol content, DPPH and ABTS radical scavenging capacities, and total flavonoid content were determined. Four lentil varieties, namely brown, yellow, red and green lentils were used for preparing the flour. The thermal pretreatments applied to the flours were roasting for 2h, blanching and boiling for 5min. A final oven cooking step was applied to the pretreated flours. Results showed that roasting alone presented a reduced effect on the overall antioxidant activity of flours, while blanching and boiling resulted in a significant increase of total phenols content, ABTS and DPPH radical scavenging capacities in comparison to raw untreated flours. Further oven cooking of pretreated flours revealed a further increase of total phenol content of blanched flours. In some cases, values exceeded those obtained for thermal pretreatment alone. For instance, in case of yellow lentils, for raw flour was registered a total phenol content of 166.9mg/100g d.m, after blanching values increased to 170.6mg/100g d.m, while for blanched and cooked sample a value of 187.3mg/100g d.m was registered.

Keywords: total phenols, ABTS, DPPH, legumes, thermal treatment

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ORGANIC AGRICULTURE IN MOLDOVA - CHALLENGES AND OPPORTUNITIES FOR NATIONAL AGRI-FOOD PRODUCTION

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Agriculture is still the primary branch of Moldavian economy, due to favorable climatic conditions and nutrient-rich soil. Taking into account the new climatic conditions and health issues of the modern world, there is an increased trend of returning to slow food concept and to organic food products. Organic farming provides fresh, authentic and healthy food, preserving ecosystems and respecting animal welfare. The focus on organic farming could be a good prospect for economic development and access to international markets for agriculture in the Republic of Moldova. In this direction, the research aimed to investigate the development of organic agriculture at local and national level. The study focused at the most important challenges and opportunities for domestic farmers. By using official information, the authors analyzed the main stages of the development of organic farming systems, and the local food market for organic products. Consumer opinion on organic agricultural products was investigated. An online survey was used, to which 242 participants responded. About 88.8% of participants have bought organic food at least once in the last 6 months. There are still ambiguities in understanding the term organic, natural and conventional for food. The results of the research could be useful to local farmers, who could focus on organic production.

Keywords: organic, agriculture, Moldova

NUTRITIONAL PROFILE OF SOME SOFT DRINKS PRESENT ON THE ROMANIAN MARKET

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In Romania, in the last 4-5 years, vitamin enriched waters are sold, and their faithful consumers are the young people who can damage their health by neglecting its quality.

In this paper, we aim to evaluate the quality of nutritional value for 6 categories of soft drinks produced and marketed in Romania: I. 5 waters enriched with synthetic vitamins and minerals, with fruit flavor (with vitamins B, D, C and minerals - Ca, Mg, Zn); II - 3 products from the same range, but zero Kcal; III.3 water products with vitamins and Mg / Zn; IV- 2 water products with Zn / Mg; V. 3 juice products with fruit extract 10-12%; VI. 2 juice products with fruit extract 30%.

In this context, we followed the nutritional information, the identification of the listed additives, the bioavailable organic / inorganic form of the added vitamins / minerals and the nutritional profile. We used for the profiling of nutrients, the SENS system. The values of the SAIN and LIM indicators for the analyzed samples were compared with the acceptability thresholds 5, respectively 7.5. The values of the SAIN indicator are zero, except for the sample that has vitamin C (SAIN = 14.44), and the LIN indicator varied between 5.23-17.66 which includes most of the samples in food class 2 and only categories in class 4. Labeling it complies with the requirements in force, and among the additives predominate: organic acids; ascorbic acid; natural dyes; benzoate / sorbate. The less bioavailable forms of the mineral element predominate.

The research results show that there is a discrepancy between the attractiveness of the product, perceived by young consumers and the real nutritional value of food.

Keywords: waters enriched with vitamins and minerals; nutritional profile

COMPARATIVE STUDY REGARDING THE CONTENT OF MINERALS AND TOTAL POLYPHENOLS CORRELATED WITH THE ANTIOXIDANT ACTIVITY OF NON-ALCOHOLIC BEVERAGES PRESENT ON THE ROMANIAN MARKET

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In this paper, we aim to assess the quality of the nutritional value of new soft drinks on the Romanian market, which have the addition of synthetic minerals / vitamins and a low percentage of fruits 1-3%, compared to those already existing with fruit extracts 10 -30%.

The samples were mineralized with HNO_3 conc. and discolored with hydrogen peroxide, a microwave digestion method was used, temperature 230°C, pressures up to 75 bar, with the atomic absorption spectrophotometer, flame technique. The results obtained, based on the standard curves recorded at the wavelengths specific to the primary line, for the mineral elements Ca (422.6728 nm), Mg (285.2125 nm) and Zn (213.857 nm), fall within the minimum limits allowed by EU Regulation 1161/2011, so that the degree of coverage is between 15-90% RDA / portion.

Total polyphenols were determined by the Folin - Ciocâlteu method, using the standard 50mg / 100mL pyrogallol solution, and the absorbance was measured at 760nm. To find out which of the products are valuable in polyphenols, but also with a healthy nutritional profile, we reported the content of polyphenols per calorie and serving (250mL). Products that have a high fruit content, at the expense of products enriched with vitamins and minerals, despite their low sugar content, were found to be valuable, obtaining values between 13-340mg polyphenols / serving.

The total antioxidant capacity (TEAC) was determined by the photochemiluminescence method, the ACL procedure, using Trolox as a standard substance. The highest values of the total antioxidant capacity (TEAC) were obtained in the case of samples containing 30% fruit, followed by those containing 10-12%, and in the case of samples with 1-3% added fruit, the values obtained have been the lowest.

The results obtained allow us to claim that some of the soft drinks on the market are nutritionally unbalanced, so they should be consumed in moderation or occasionally.

Keywords: fruit juices, vitamin and mineral waters, polyphenols, photochemiluminescence

IMPACT OF PULSED ELECTRIC FIELD ON CONVECTIVE DRYING OF APPLES AND ITS SELECTED PHYSICOCHEMICAL PROPERTIES

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Traditional convective drying is a process commonly used in food processing. At the same time, this method is regarded to be the most destructive amid all drying methods. The reason is the long drying time and thus the long exposure of the material to high temperature and oxygen, which negatively affects the quality of the dried product. Various pretreatments are used to accelerate convective drying. The pulsed electric field is non-thermal technique, which interferes with the cellular structure of the material and causes the breakdown of the cell membrane (electroporation). The ruptured cell membrane is characterized by increased permeability.

The aim of this work is to analyze the impact of the pulsed electric field and variable process parameters on the drying kinetics and selected properties of the obtained dried apples (color, polyphenol content). "Golden Delicious" apples were preliminary treated with a pulsed electric field (energy input: 0; 1; 3.5; 6 kJ/kg), and then dried by convective method (temperature: 55, 70, 85°C). The application of pulsed electric field pretreatment and increasing the temperature of the drying air reduced the drying time. In comparison with materials dried without any pretreatment, the samples treated with pulsed electric field were darker. Moreover, the use of the pulsed electric field caused lower retention of polyphenols in dried apples.

In summary, pulsed electric field is a promising technique to improve the drying process mainly by improving the permeability of cell membrane due to appropriate tissue damage. Many undesirable changes in quality characteristics, such as browning or loss of nutritional value, are closely related to changes in the microstructure during processing. Therefore, further research should focus on the relationship between changes in microstructure and the physicochemical properties of the material.

Keywords: pretreatment, air drying, polyphenol, color

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ANALYSIS OF THE EMULSION PROPERTIES ON THE EXAMPLE OF A MILK ICE CREAM MIX FOR ICE CREAM PRODUCTION

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The ice cream mix is described as a multiphase system. The physicochemical and organoleptic properties of ice cream are determined by the relevant quality of the ice cream mix. Therefore, the preparation of ice cream mix and selecting ingredients especially stabilizers, are crucial to obtain lucrative results. Additionally, the homogenization process contributes to obtain better stability of the emulsion and decrease fat globule size compared to non-homogenized ice cream mix.

This study aims to determine the influence of selected stabilizers and homogenization process on physicochemical properties of emulsion and to observe changes which could occur during 24 hours of storage, on the example of ice cream mix for the production of milk ice cream. The four variants of the ice cream mix were prepared, differing in the method of stabilization (the use of iota-carrageenan, xanthan gum and LGB) and the application of the mechanical homogenization process. All variants were tested for active acidity, density, viscosity, particle size distribution, morphology and stability after preparation and after 24 hours of storage at the temperature of 4°C.

Finally, it was found that the addition of stabilizers caused an increase in the viscosity (143.83 mPas) and particle size diameter D50 (14.6±3.1μm) of the ice cream mix. Whereas the homogenization process contributed to obtaining better results in the mentioned parameters. Additionally, the use of stabilizers and the homogenization process negatively affected the stability of the emulsion due to the fact that the stability rate (TSI) was noticed at 5.8. There were no statistical differences in density and pH of the estimated samples of ice cream mix.

Keywords: ice cream mix, emulsion, homogenization, stabilizers

INFLUENCE OF CAROTENOID CONTENT IN SEA BUCKTHORN POWDER ON *BACILLUS SUBTILIS* INHIBITATION

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Sea buckthorn is an important source of biologically active compounds with antimicrobial effect. The aim of the study was to investigate the influence of total carotenoid content in sea buckthorn powder on pathogenic bacteria *Bacillus subtilis*. The antimicrobial effect of the sea buckthorn powders was determined *in vitro* on pathogenic microorganisms *Bacillus subtilis* ATCC 6633, which can cause ropiness in bread products from wheat flour. Were researched 10 local sea buckthorn varieties: C6, R1, R2, R4, R5, AGA, AGG, Mr. Sandu, Seirola and Pomeranskaia (*Hippophae rhamnoides* L.). The total carotenoid content of these varieties was also determined. The total carotenoid content of the analyzed varieties varies in the range of 0.34 mg/100 g. to 2.09 ± 0.03 mg/100 g. It was found that the values of the total carotenoid content in powders decrease in the following order: R1>Seirola>Pomeranskaia>Mr.Sandu>R5>R4>AGG>C6>R2>AGA. The carotenoid content determined in the R1 variety is 6.1 times higher than the AGA variety. Sea buckthorn powders showed a pronounced antimicrobial activity that constitutes a range between 19 and 29 mm in diameter of the inhibition zone and decreases in the order: AGA>AGG>Mr.Sandu>C6>Seirola>R5>R4> R2Pomeranskaia>R1. As a result of the tests performed, it was found that the AGA variety achieves a more pronounced antimicrobial activity than *Bacillus subtilis*, which is 29 mm in diameter of the inhibition zone, and a weaker antibacterial effect is denoted in powder R1 with 19 mm in diameter. It has been established that the correlation between the total carotenoid content and the antimicrobial activity is R^2=0.31. The inhibitory effect on Bacillus subtilis is probably due to other bioactive compounds such as flavonoids. Bibliographic sources show that flavonoids, due to the -OH groups, tend to be incorporated into the membrane and cell wall of pathogenic microorganisms, thus changing their fluidity, permeability and lead to weakening of the membrane potential, contributing to the death of microbial cells.

Keywords: sea buckthorn, carotenoids, antimicrobial activity, *Bacillus subtilis*

Acknowledgment: The authors would like to thank the Moldova State Project no. 20.80009.5107.09, "Improvement of food quality and safety by biotechnology and food engineering", running at Technical University of Moldova.

INFLUENCE OF PRETREATMENTS ON CONVECTIVE DRYING KINETICS, BIOACTIVE COMPOUNDS, AND QUALITY OF TEREBINTH

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The aim of the research is to evaluate the effect of the pretreatments on convective drying kinetics, bioactive compounds (total phenol and total flavonoid contents), and quality (color and rehydration ratio) of terebinth. The terebinth was subjected to ultrasound, blanching and microwave pretreatments (each pretreatment at three levels) and drying was conducted using the three temperatures 50, 60 and 70°C with the air velocity 0.5 m/s.

Results shown that the time of drying decreased while increasing temperature and after applying different pretreatments compared to the control sample without pretreatment. The shortest drying time (55 min) was obtained at the air temperature of 70°C with the application of microwave pretreatment before the drying process. The highest amounts of total phenol and total flavonoid contents were obtained by ultrasonic pretreatment and drying at a temperature of 60°C, obtaining 153.35 mg GAE/g d.m. and respectively 49.24 mg QE/g d.m.. The lowest bioactive compounds were obtained by drying in 50°C without pretreatment, obtaining the total phenol content in the amount of 128.57 mg GAE/g d.m. and total flavonoid content in the amount of 32.05 mg QE/g d.m. The highest and lowest rehydration ratio of dried terebinth was noticed for ultrasonic pretreatment at air temperature 60°C (3.24) and for control sample dried at air temperature of 50°C (1.95), respectively. Moreover, the lowest and highest color (ΔE) for terebinth sample was obtained at air temperature 60°C with ultrasonic pretreatment (13.43) and air temperature 50°C and without pretreatment (24.26), respectively.

Among the various pretreatments, the microwave had the best result in terms of drying time. Ultrasound gave the best results for preserving bioactive compounds and the overall appearance of dried terebinth.

Keywords: terebinth, drying, total phenol contents, total flavonoid contents, rehydration ratio

CONSUMER BEHAVIOR RELATED TO IODINE-RICH FOODS INTAKE IN THE REPUBLIC OF MOLDOVA

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Iodine is one of the vital microelements with high biological activity, 90% of which is provided by the use of products rich in iodine. The problem of iodine deficiency is especially relevant in the Republic of Moldova, in which, according to UNICEF data, at least 85% of the population are at risk of iodine imbalance diseases. The national program for the eradication of iodine deficiency disorders by 2015 was mainly focused on the universal iodine fortification of food salt because of its availability, widespread popularity among the population, and simplified technology of obtaining. However, there is a lot of controversial information about the lack of effectiveness of this strategy. It is known that iodine from salt evaporates during heat treatment and at the slightest breach of storage conditions. Furthermore, according to the latest WHO recommendations, the rate of salt intake should be reduced by two times (from 11 to 5 g per day), which contradicts the need to maintain a constant level of salt intake to replenish iodine deficiency.

One of the solutions to this problem may be to inform the population about iodine-rich foods and their correct use, taking into account the age, gender, citizens residence region and professional activities. According to the data obtained during the population survey in the period January – May 2021, about 67% of respondents use iodized salt in their daily diet, while the prevention program is considered effective if more than 90% of the population consumes iodized salt. The majority of respondents (namely 77.3%) indicated that they were familiar with the problem of iodine deficiency and mostly prefer to consume foods containing iodine (56.5%) or foods fortified with iodine (40.1%) to prevent iodine deficiency diseases. To inform consumers about the content of iodine that they may receive with each product, it is recommended to provide the information on food labels.

Keywords: essential mineral, population survey, iodine deficiency, iodized salt

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ASPECTS OF WALNUT OIL (*JUGLANS REGIA L.*) APPLICATION FOR NEW FUNCTIONAL PRODUCTS OBTAINING

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Nowadays, foods fortified with essential omega-3 and omega-6 polyunsaturated fatty acids (PUFAs) stand out among different types of functional products due to their high biological potential. The replacing of traditional lipids with walnut oil (*Juglans regia L.*) containing up to 83% polyunsaturated fatty acids could become a new trend in the food industry. On the other hand, the use of lipids in the form of walnut oil is a complex technological problem due to its irreversible rapid oxidative changes. To prevent the process of oxidative degradation of polyunsaturated fatty acids different food compositions based on walnut oil were studied.

The rheological analysis of lipid systems with walnut oil showed that solid vegetable fats balance the melting points of the vegetable oils mix due to the high concentration of saturated fatty acids. Walnut oil becomes a product with a spreadable texture and a melting temperature similar to that of vegetable shortening (30 ± 3°C) in compositions with 10...30% cacao butter, 30...50% palm oil, and 5...15% coconut oil (Figure 1). Contrary to the fact that palm oil (27.1 ± 0.1°C) doesn`t have the highest melting temperature compared to cocoa butter (31.2 ± 0.2°C), exactly this product prevails in stabilized samples. The composition of palm oil consists essentially of saturated fatty acids with a longer aliphatic chain $C_{<n>}$ (<n> = 16.16) than in cocoa butter (<n> = 15.25). Thus, the solid composition of walnut oil can be obtained by combining it with 15% saturated fatty acid with a carboxylic chain length n = 18. “Rancimat” analysis showed, that the oxidative stability time of the mixture of walnut oil with palm one (1:1) is 1.15 times longer than in the same blend with cacao butter. The presence of monounsaturated fatty acids in the composition accelerates the oxidation of walnut oil, the induction time of its blend with oleic (1:1) acid being 2.4 times shorter than that of pure walnut oil. The stabilization of walnut oil PUFAs by design of balanced and structured compositions with saturated solid vegetable fats is a good and safety way in order to obtain new functional food products such as vegetable shortening with high biological value.

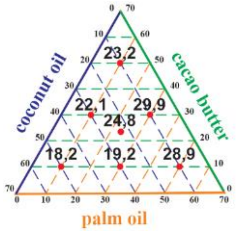

Fig.1. Melting temperatures of fat systems containing 30% Walnut oil

Keywords: polyunsaturated fatty acids, oxidative stabilization, saturated fats, shortening

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.

PROSPECTS FOR USING SEA BUCKTHORN BERRIES FOR HEALTHY FOOD PRODUCTION

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The article presents the results of analyses of several new varieties of sea- buckthorn growing in the Republic of Moldova - Hergo, Mr. Sandu, Pomorancevaia, Roori, Seirola and their qualitative indicators are defined: a comparative biomorphological characteristic is given, the results of mechanical analysis of sea-buckthorn berries are provided. Pomorancevaia and Seirola are allocated for large-fruit (average weight of 100 berries 44-62 g), the stability of the berries mass - Mr. Sandu, Pomorancevaia and Roori; small-numbered–seeds - Mr. Sandu, Pomorancevaia and Seirola; the lowest correlational dependence of the berry mass on the number of seeds - Roori and Hergo. There have been presented the results of studies aimed at studying the composition of biologically active substances of buckthorn fruits. The studied varieties contain 30-98 mg/% provitamin A, 38-780 mg/% of ascorbic acid, B vitamins. Increased sugar content (10-15.0%) and the acid content of 1.6 to 3.2% determines a specific balanced taste. The sugars are mainly fructose and glucose, the content of which determines the therapeutic property of sea-buckthorn berries. The article deals with the results of epiphytic microflora composition of the studied varieties of sea-buckthorn. Grown colonies after premicroscopy were singled out in cultures and subjected to testing on cultural and morphological grounds, guided by determinants and manuals. Epiphytes have antagonistic properties, acting as a natural protective barrier and thereby strengthening the plant's natural immunity. The theme of introducing sea-buckthorn into food products is progressing and provides an opportunity to develop the food industry. The authors developed a formulation of biscuit with the addition of sea-buckthorn meal of about 10-20% and quality indicators have been analyzed.

Key words: sea buckthorn, bioactive compounds, antioxidant activity, therapeutic and prophylactic properties

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

CHANGES IN BREW TECHNOLOGY TO REDUCE GLUTEN CONTENT

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At present a relatively large population can not drink traditional beer due to problems derived from celiac disease, autoimmune disease caused by intolerance to gluten, proteins present in several cereals such as barley and wheat. Actually, it is know that this disease is systemic and not only a digestive issue, because the abnormal immune response caused by the gluten can produce different antibodies that can attack organs and systems.

The main objective of this study is to examine the influence of mash temperature in the break of the gluten chains presents in brewing to determinate what is the best process to create a free gluten beer that keeps the qualities of the final beer. Tests and analyses were carried out according to the type of beer and mashing conditions. In Ale beer, infusion mashes were carried out with three temperature steps. On the other hand, a five-step decoction mash was carried out for lager beer. In the first part of the study, pH, density, color and bitterness were determined. In the second, the gluten content was determined by high-performance liquid chromatography (HPLC).

The results obtained show that the addition of propyl endoprotease enzimes in fermentation, is a clever method to brew a free gluten beer, the variation of the mash degrees has an influence on gluten quantity, and it is necessary to continue with the search of a more exact method that ensure us better values

Keywords: celiac, gluten, beer, brewing, mash

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PRODUCTION OF LOW-CALORIE GRAPE JUICE (BABEASCA NEAGRA VARIETY) JELLY WITH SEVERAL GELLING AGENTS

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Jellies are soft, elastic, consistent but spreadable products obtained from fruit or vegetable juice without any piece of fruits inside. Most of the commercial jellies are sweet due to the sugar or other sweeteners addition. The purpose of this study was to use a valuable raw material such as grape juice from Babeasca neagra variety to obtain and characterize some jellies with two commercial gelling agents (agar-agar, agar-agar-pectin). The samples were prepared without sugar addition and were processed with a multicooker using the special program for jams at 100°C for 30 minutes. After the processing, the samples were packed and sealed into jars and stored to the room temperature (21°C) at dark for 28 days. The jellies were tested in 0, 7, 14, 21 and 28 days by total phenols and flavonoids content, anthocyanins, antioxidant activity, color, consistency and texture, as well as sensorial point of view. The absence of sugar does not affect the main characteristics of the gel formation. The phytochemical properties of the samples are comparable for both gelling agents. The color of the samples was not influenced by the gelling agents addition neither by the thermal treatment or the storage time. The textural analysis of the jellies showed a slight decrease in firmness during the storage time, for all the samples. The maximum overall acceptability score was registered for both types of jelly. However, the challenge to warrant shelf-life stability was reached.

Keywords: jelly, grape juice, gelling agents

COMPOSITION OF ACID WHEY DERIVED FROM COMMERCIAL SET TYPE AND TRADITIONAL GREEK YOGHURTS

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The serum of yoghurt, known also as acid whey (AW) from the production of Greek strained yoghurt, is a by-product in which attention has been paid lately. In this study, the serum of yoghurt, here called AW, which was obtained from samples of two different types of Greek yoghurt, i.e. from set type yoghurt (SY) and from traditional Greek yoghurt (TY), which is made with non-homogenized milk, was analyzed for its chemical composition as well as for the sugar and whey proteins profiles. Nineteen samples of SY and 21 samples of bovine or ovine TY were used to obtain their AW after centrifugation at 5410 rpm/10^{o}C for 15 min. Depending on the fat content of yoghurt, yields of AW ranged from 44.48 ±3.52 to 50.01±6.13 g/100g of SY and from 43.86±4.52 to 45.47±5.46 g/100g of TY. pH of AWs from SY and TY, both with fat 4% was 4.30±0.08 4.03±0.17, respectively. Determination of composition by Infra-Red spectroscopy showed that dry matter content did not differ among the AW samples, whereas fat, protein and ash contents differed significantly ($P<0.05$). Analysis of sugars by HPLC showed that the percentage contents of lactose and galactose in AW from TY were 3.04±0.86 and 1.53±0.34 respectively, while the correspond values in AW from SY were 4.15±0.91 and 0.93±0.10. Moreover, since milk proteins may be added during yoghurt production, the profile of non-denatured whey proteins determined by RP-HPLC differed among the AW samples. In conclusion, the composition of the serum of yoghurt differs substantially not only among the different types of yoghurt but also among the different samples of the same type of yoghurt. This should be always taken into consideration, when the AW produced during the Greek strained yoghurt manufacture is to be further processed to extract valuable food ingredients.

Keywords: Acid whey, lactose, galactose, whey proteins, HPLC

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EFFECT OF *SATUREJA HORTENSIS* L. EXTRACT ON THE SHELF LIFE OF SOFT-FRESH CHEESE

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Extending the cheese shelf-life is an important factor in the dairy industry because it can decrease the economic impact, by reducing losses attributed to spoilage and expanding by distribution of cheese in new markets. Addition of preservatives is one of the simplest and oldest ways to prolong the cheese shelf life. Alternative preservation techniques using naturally derived ingredients are being investigated in cheese making, with the use of spices and herbs, attracting even more interest. *Satureja hortensis* L. extract was used in five concentrations (0.1, 0.2, 0.3, 0.4 and 0.5 g/100mL milk), the soft-fresh cheese samples were vacuum packed. Treatment of cheese with 0.1 and 0.2% extract (T1 and T2) is recommended for antioxidant and sensorial quality. The cheese samples showed significant DPPH scavenging activity (IC_{50} 0.18 g/100mL milk) compared with the values obtained for ascorbic acid. Total solids, fat, protein, and pH were measured and no significant differences were observed in compositional parameters of the cheese samples. *Satureja hortensis* L. extract showed significant antibacterial activity against strains of Gram-positive bacteria (*Staphylococcus aureus* ATCC 25923), while the inhibitory effect on Gram-negative bacteria (*Escherichia coli* ATCC 25922, *Salmonella abony* ATCC 6017) is less pronounced. As a result, the shelf life of the selected samples (T1 and T2) at sensorially, physicochemical and microbiologically level is 21 days, while the shelf life of the control samples is 14 days. Therefore, the use of *Satureja hortensis* L. extracts as a natural ingredient has great potential as a substitute for natural preservatives and antioxidants with significant antimicrobial activity against foodborne pathogenic and spoilage microorganisms, thus contributing to extending the food product shelf life.

Keywords: antibacterial activity, DPPH scavenging activity, *Satureja hortensis* L. extract, shelf life.

Acknowledgment: The authors would like to thank the Project 20.80009.5107.09 "Improvement of food quality and safety by biotechnology and food engineering" and 20.00208.1908.03 "Principles of dairy processing correlated to balanced nutrition and food safety", funded by the Government Republic of Moldova.

MICROBIOLOGICAL ASPECTS OF GOAT'S MILK YOGURT WITH THE ADDITION OF SCALD FRUITS

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Yogurt is a lactic acid product with valuable functional properties whose physico-chemical characteristics are the subject of numerous researches. In this paper the study object is goat's milk yogurt with the addition of scald fruits (peach, raspberry and strawberry). The aim of this research is to highlight the antimicrobial properties of goat's milk against pathogenic bacteria and increase these properties by adding scald fruit, thus transforming goat's milk yogurt with scald fruit into a microbiologically safe product. To perform the study, the growth rate of lactic acid bacteria measured by the optical density at 600 nm and the amount of lactic acid determined by titration. Growth rate of lactic acid bacteria during storage (15 days) sowed the results: control sample 2,10 - 2,12 · 10^7 ucf/ml, yogurt sample with peach 2,72-2,75· 10^7 ucf/ml, yogurt sample with raspberry 2,80-2,87· 10^7 ucf/ml, yogurt sample with strawberries 2.25-2.26· 10^7 ucf/ml. The growth rate of lactic acid bacteria in the samples of yogurt with added fruit compared to the control sample was an increase from 6.60% yogurt with strawberries to 35.37% for the sample of yogurt with raspberries. The difference in the lactic acid bacteria growth rate in the researched samples is probably due to the fact that the addition of scald fruits constitutes an improvement of the bacterial growth medium. The yield of lactic acid is directly proportional to the lactic acid bacteria vital activity of the starter culture. Respectively, the maximum amount of lactic acid was obtained for the yogurt sample with the addition of raspberries (0.094-0.116 g) followed by the sample of yogurt with the peach addition (0.080-0.103 g). At the same time, the intensive growth of bacteria does not lead to excessive accumulation of lactic acid, which favorably influences the physico-chemical and organoleptic parameters of dairy products. Based on the experimental study, it was shown that fruits have antimicrobial properties and form a synergism with starter culture microorganisms in goat's milk yogurt with scald fruits. The most relevant results were obtained for the yogurt sample with added raspberries followed by the yogurt sample with added peach.

Keywords: goats milk, fruits, lactic acid, lactic acid bacteria

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RESEARCHES ON THE USE OF SPIRULINA IN THE PRODUCTION OF FLOUR PRODUCTS

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The study includes a documentary survey of the main categories of cereal products, their flours and dyes used as a raw material in the production of flour products. There are presented the technologies for the production of cookies, methods of obtaining the flour and the possibilities of using natural dyes and spirulina in the food industry. This research is aimed at the manufacture of bakery products for people suffering from gluten intolerance, and correspond to the following requirements: to be gluten-free, absence of allergic factors, characterised by nutritional principles necessary for correction of metabolism disorders, accessible price and high quality. For the manufacture of gluten-free bread were performed the following: use of rice and soriz flours, which are gluten-free; determining the optimal dose of the flour used for development of the manufacturing network; describing technological stages and parameters examining the properties of dough and bread.

Nowadays more and more people are suffering from gluten intolerance. Gluten comprises the proteins contained in wheat, oats, barley and rye. The proteins contained in these cereals are toxic for the people suffering from gluten intolerance. The treatment includes complete exclusion of gluten from the diet and replacement of the cereals containing this element with products obtained from gluten-free cereals.

The recipe of gluten-free products may include corn flour, potato flour and starch, buckwheat flour, rice flour and flour from other vegetables and pseudo-cereals like soriz. These raw materials do not have a gluten fraction to provide the essential protein network, that is why several problems may appear when processing the dough.

In order to avoid such problems, several treatments applied to raw materials may be used in order to modify the proteins by use of enzymes or other linkage products.

The aim of this study is to obtain bread from rice and soriz without gluten for the consumers suffering from celiac disease. In order to create a uniform matrix for the starch granules, gelatinization of at least a part of the rice and soriz flour is applied, to obtain a chain for the flour left.

DISEASES TRANSMITTED FROM WATERBORNE TO HUMANS

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Purpose: Water is a source of life and clean drinking water is an underlying necessity of humans. The quality of water has been measured by the materials existing in it. Water, as a vital component of the ecosystem, is being contaminated daily.

Result: This study has illustrated information about the waterborne illness and multiple epidemics associated with the consumption of polluted or improper treatment of water is gradually raising global public health concern and is being a significant cause of morbidity and mortality. Contamination of water by pathogenic microorganisms is now a growing problem. Moreover, there are loads of reasons leading to poor quality level. Also, they cause a string of diseases that transmit to human beings consisting of microbial, bacterial and infectious even unfamiliar illnesses. Additionally, there are three types of transition including diseases of water origin, diseases transmitted through washed water, Water-related diseases, Insects carrying water-related diseases.

Conclusion: Water analyses ought to carry out to ensure that drinking water should be clear, free from offensive taste or smell, free from chemicals or compounds contaminations that may have adverse effects on health or harmful in long term and free from pathogenic organisms.

Keywords: waterborne, human, contaminated, disease, transmission.

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AIRBORNE DISEASES AS THE DISEASES TRANSMITTED TO HUMANS

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Purpose: Air is one of the most essential human needs, has a variety of microorganisms that can cause infectious and allergic diseases in humans.

Result: The present study has indicated information about the airborne transmission and self-inoculation (direct contact) are two modes of infectious diseases transmission via pathogens. Bioaerosols are airborne particles that are alive (such as bacteria and fungi) or originate from living organisms. Diseases spreading via the respiratory tract, such as Measles, Tuberculosis, Influenza, and the coronavirus disease 2019 (COVID-19) have played dramatic and important roles in the universe of public health. The particles that cause airborne diseases are so small, therefore, they can stick to the air. They hang on dust particles, moisture droplets or breath until they settle.

Conclusion: In most cases, airborne diseases are easily treatable. Although it is difficult to completely prevent them, there are ways to reduce the risk of exposure to pathogens.

Keywords: airborne, infectious, allergic diseases, transmission

Acknowledgment: The authors thank our colleagues for collecting information for this paper as an article.

TRANSGLUTAMINASE IN SHAPING QUALITATIVE CHARACTERISTICS OF BUCKWHEAT GLUTEN-FREE SOURDOUGH BREAD

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In the contemporary world it is important to strive for psychophysical balance, one of the components of which is nutrition. Reaching for valuable and nutritious products is the basis for composing a healthy diet that translates into our wellbeing. However, many people struggle with ailments that impose some diet limitations. These include people suffering from celiac disease, who require gluten elimination.

Gluten-free (GF) bread lacks the main structure-building component, which however may be replaced in the dough to improve the texture and overall quality of the final product. One such additive is the enzyme transglutaminase, which is able to link proteins into larger molecules.

The study involved the determination of the impact of transglutaminase as a dough conditioner in the bread produced with buckwheat flour fermented using lactic acid bacteria starter cultures (*L. plantarum* ŁOCK 860 and *L. brevis* ŁOCK 1267).

A synergistic effect between the action of transglutaminase and the sourdough was observed. Although the sourdough led to a reduction in the specific volume of bread, other parameters improved. The porous structure changed visibly, while the crumb was more cohesive and elastic. Less crumbling was observed. The specific volume of the bread increased with respect to the trial with sourdough only. The porous structure was more homogeneous. Microscopic examination revealed a visible improvement in the quality of the bread crumb, indicating a stronger protein network. The overall acceptability increased, as the characteristic bitter aftertaste of buckwheat was less noticeable, especially thanks to the use of sourdough.

Overall, the simultaneous use of buckwheat sourdough and transglutaminase had a positive effect on the acceptability of the GF buckwheat bread. This research opens the way for the development of more nutritious and varied GF alternatives to traditional bakery products.

Keywords: gluten-free bread, transglutaminase, sourdough, buckwheat bread.

Acknowledgment: The authors gratefully acknowledge the COST Action 18101 SOURDOMICS - Sourdough biotechnology network towards novel, healthier and sustainable food and bioprocesses.

DESIGNING AND DEVELOPMENT OF WALNUT-BASED INNOVATIVE FOODS: TECHNOLOGICAL AND NUTRITIONAL IMPACT

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With growing understanding of the relationship between diet and health has come the emergence of so-called innovations in food industry in order to design and develop healthy and nutritious foods. The idea of using food for health purposes and not merely as a source of nutrients opens up a new field in walnuts processing. In addition to traditional presentations, there is a number of ways in which the walnut sector can modify the qualitative and quantitative walnut food composition and produce designer foods with specific properties (sensory, technological, hygiene, stability, etc.), nutritional value (balanced composition and bioactive substances) and their health effects. This research reviews a comprehensive approach for the development of walnut-based foods (Figure 1). Potentially walnuts were used to obtain these foods, not only able to exert health benefits, but also as an alternative to other food products. Processing steps and conditions to ensure chemical composition, quality, nutritional properties, structure and rheological behavior of walnut-based food products were analyzed. Results show high potential and positive view on walnut industrial processing, in agreement with the current demand of healthy and innovative food products.

a) b) c) d)

Figure 1. Samples of walnut-based food products: a) Walnut oils with high oxidative stability, b) Walnut dressings, c) Walnut by-products bioactive compounds, d) Walnut beverage emulsion

Keywords: walnuts, nutrition value, processing, innovative food

Acknowledgment: This work was done in the framework of Project 15.817.02.30A, "Development of methods and techniques for modernization of nuts (*Juglans Regia* L.) processing technology using their biologically active constituents in the functional foods", founded by the Academy of Science of Moldova.

NUTRITION AND DIET IN CANCER PREVENTION

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Food as an important factor in cancer incidence. Food is an important factor in determining cancer incidence in many countries and regions. A diet rich in vegetables and fruit is generally associated with reduction in the risk of many types of cancer. Mediterranean diet has consistently been shown to be beneficial in preventing cancer.

Anticancer food-related components. There are three crucial characteristics of innovative anticancer agents relate to their capability in killing cancer cells. The majority of food-related components that are beneficial to human health are of natural origin, some of them display anticancer effects (from plants, macroscopic mushrooms, terrestrial and marine invertebrates).

Recommendations for cancer prevention. Improved food, better lifestyles and developments in the functional food industry are all crucial to cancer prevention (Figure 1).

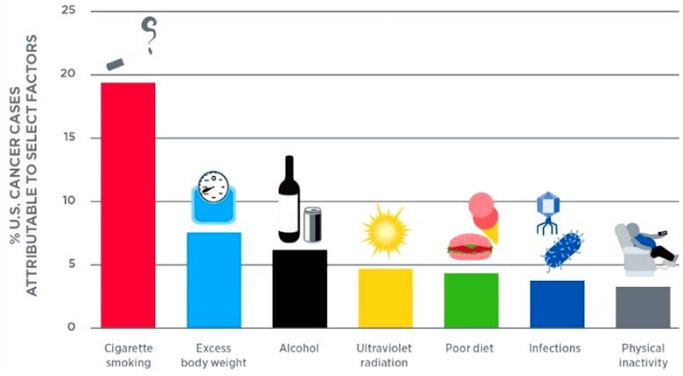

Figure 1. Risk factors of cancer

However, we need to carry out better designed and better controlled studies with different end points. Notably, increased body mass index and obesity and lack of regular physical activity have been associated with increased cancer risk for most cancers.

Conclusions. Healthy nutrition, physical activity and lack of stress are the three most important components of health. Modification of food habits may prevent many cancers and result in a healthier population and significant savings in healthcare expenditures. Potential anticancer effects of food-related components should be further researched in clinical trials on different models for their effectiveness and toxicological documentation.

Keywords: cancer prevention, nutrition, diet, anticancer food-related components

CLEAN LABEL TREND IN GLUTEN-FREE BAKING

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Clean label definition is linked mainly with such phrases like ‘’natural” or ‘’free from’’ and ingredients that are easily recognizable and considered as safe. Consumers link to "clean" foods such features as i.e. minimal processing and not containing artificial additives (understood as additives with E-codes). Shorter ingredient lists are achieved by re-formulating products to make them closer to a ‘’home-made” or ‘’traditionally-made” style.

Although ingredients can be produced from entirely natural source materials, this does not automatically qualify them as having clean label. Many ingredients of natural provenance are on European food additives list and having E-numbers. Choosing the right ingredients that will imitate all technological properties of gluten therefore is a complex issue.

The aim of the research was to develop new technological solutions for the manufacturing of a gluten-free bread with clean label due to the use of texturants of natural origin (classified as food ingredients without E-number).

The possibility of replacing guar gum with the help of β-glucan and psyllium in various dosages was checked in the model gluten-free bread. The best results were obtained for baked goods containing β-glucan. Products with this ingredient were characterized by a proper specific volume, crumb moisture and structure, as well as acceptable taste and flavor comparable to the control sample (with guar gum).

An extensograph study revealed that the sample with the highest extensibility was a blend of wheat starch, quinoa and psyllium. Despite relatively high extensibility value obtained by this sample, this result was half the result obtained for the reference material (wheat flour).

A farinograph study revealed some options with potential for further improvement. Quinoa and β-glucan blend achieved a consistency value identical to that of wheat flour. However, stability of such batter was really low. The opposite effect was noticeable for the blend of quinoa and psyllium.

These findings support researchers to carry out studies in this field. Further analyses are required to clarify whether a synergistic effect is observed when a combination of these texturants of natural origin is being used.

Keywords: bakery, gluten free diet, gluten free bread, natural ingredients, clean label

RHEOLOGICAL AND FUNCTIONAL PROPERTIES OF FORTIFIED GLUTEN FREE SOURDOUGH SORGHUM BREAD

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Sorghum is a unique cereal with increased health benefits. In this study, effects of sourdough addition on the technological properties of sorghum bread was investigated. Red sorghum flour was processed into gluten-free bread supplemented with sourdough at different levels (10%, 20% and 30%) using functional lactic acid bacteria (*Lactobacillus casei*) and yeast (*S. cerevisiae*) as starter cultures. The effects of sourdough addition on the functional (antioxidant activity and total phenolic content), rheological (dough hardness and stickiness) and textural (hardness, adhesiveness, springiness, cohesiveness, gumminess and chewiness) properties of gluten free sorghum-based breads were investigated. Unlike the traditional sorghum-based bread, the formulation has been enriched with chickpea protein and apple fiber to improve the quality of gluten-free bread. Adding 30% sourdough, led to decrease in the pH (5.10 to 4.64) and increase in the total acidity (0.57% to 0.75%) at the end of the fermentation process. As increase in sourdough addition up to level of 30%, dough hardness decreased (from 297.92 g to 84.16 g) while stickiness increased (from 100.01 g to 122.40 g). Texture Profile Analysis (TPA) of bread samples show that the sorghum sourdough bread fermented with 30% level of *L. casei* had the least hardness (374.73 g), gumminess (247.70) and chewiness (236.14) values while springiness and cohesiveness remained almost the same as the control sample. Molecular structure changes in the proteins due to addition of sourdough were determined with the FTIR experiments. Total phenolic content was in range between 70.42 and 76.44 mg GAE/ 100 g DW. 10% *L. casei* sourdough bread had the highest radical scavenging effect (37%) while the control had least (33 %). Sourdough sorghum breads could be served as a good source of phytochemicals and safe for consumption by people suffered from celiac disease.

Keywords: sorghum, sourdough, gluten-free bread, lactic acid bacteria

THE QUALITY OF SPIRULINA BIOMASS AFTER DRYING TREATMENTS

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Spirulina biomass is used in the pharmaceutical, food and cosmetic industries. One of the conditions for keeping the microalgae and cyanobacteria biomass is the maximum humidity of 10%. The main objectives of drying the algae biomass are to maintain the biologically active content, to reduce the storage volume, to extend the shelf life of the products for further storage and processing. Microwave drying is considered to be less harmful to the environment and humans.

The purpose of this study was to analyze the effects of microwave drying techniques on the biochemical composition of dry biomass. Two drying techniques have been studied. In order to identify the best drying method, microwave drying and combined drying method were studied. Better drying parameters were identified based on the proteins and fats content.

The better results (proteins concentration – 66% and lipids content – 4,2% biomass) presented by samples microwave at 525W power (40% of microwave power) simultaneous with forced convection at 40°C for 7 min and microwave at 525 W power (50% of microwave power) simultaneous with forced convection at 40°C for 5 min are explained by the effect of microwaves on the Spirulina cell structure and the use simultaneous of forced convection at 40°C. Forced convection at 40°C facilitates mass transfer by reducing drying time and the effect of heat treatment on the biochemical composition of spirulina biomass.

It was found that the values obtained for the native biomass perform the same nutritional value compared to that of dried biomass by combined methods. The method was tested for spirulina biomass obtained under different conditions: addition of stimulators; gold and silver pegylated nanoparticles.

Acknowledgment: The results were obtained within the project 20.80009.5007.05 funded by National Agency for Research and Development, Republic of Moldova.

UTILISATION OF MORINGA POWDER (*MORINGA OLEIFERA L.*) AS A NUTRITIVE SOURCE IN VARIOUS FORMULATIONS OF GLUTEN-FREE MUFFINS

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In recent years, the percentage of the population that has adopted a gluten-free diet has increased. Due to the increased demand for gluten-free cereal products the need to diversify these products has become a priority for scientists. Although gluten-free cereal-based products are known for their sanogenic effects, they have a low nutritional value, characterized by low dietary fibers, proteins, minerals, and sensory characteristics.

Moringa oleifera L. is a nutrient-rich plant that is used widely as a food supplement. Using the moringa powder in gluten-free pastry products formulations can represent a good source of proteins, minerals (potassium, calcium, magnesium), dietary fiber, vitamin A, C, E, and phytochemicals like sterols, tannins, flavonoids, and terpenoids.

In this study, two formulations of gluten-free rice-based and oat-based muffins were supplemented with 5%, 10%, 15%, and 20% moringa leave powder (DPML). The ingredients used in their formulation were analyzed regarding relevant studies and research. In addition, the chemical composition, physical, nutritional value, including *in vitro* protein digestibility, and sensorial characteristics of muffins were investigated. The results showed an increase in the content of fibers and proteins. However, with the increase of moringa powder content, consumer acceptability has decreased, especially in oat-based formulations. Also, by increasing the amount to over 10% moringa powder, *in vitro* protein digestibility occurs partially. Consequently, moringa powder is a viable source of protein and fiber to supplement the intake of these compounds brought by the other ingredients into muffins formulations. However, according to the results obtained, the addition of moringa powder should be around 10% so that the sensory qualities are not affected.

Keywords: *Moringa oleifera*, gluten-free, in vitro protein digestibility

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SALMONELLA DETECTION METHODS FOR FOOD INDUTRY

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Salmonella enterica is a serious foodborne pathogen that causes severe and sometimes fatal infections. The greatest risk to public health is posed by raw meat, poultry (chicken, duck, goose) that were not sufficiently cooked, as well as eggs and their productsб ect. [2]. Salmonellosis is the cause of a high medical and economic burden around the world. Therefore, the development of fast, effective and reliable methods for the detection of *S. enterica* in food continues to be developed, allowing the detection of the pathogen at the earliest stages of production, when it will still be possible to take adequate measures to prevent its further spread, contamination of production equipment and infection of the consumer. The classical microbiological method, the so-called "gold standard", serves as the basis in food testing laboratories. But it is very time consuming and laborious. In modern conditions of the development of the food industry, it would be especially promising to use molecular biological methods, therefore, in this work, a literature review was carried out on the rapid diagnosis of *Salmonella spp.* using PCR-RT, which allows not only to identify the pathogen and its biovars, but also to quantify the degree of product contamination. The method is fast, highly effective, sensitive and specific, which significantly improves the quality of microbiological control in the food industry.

Keywords: *Salmonella enterica,* foodborn infections, PCR - RT method

Acknowledgments: This work was funded by the State Project 20.80009.5107.09 "Improving of food quality and safety through biotechnology and food engineering", running at Technical University of Moldova

UNRIPE APPLES – SOURCE OF NATURAL ORGANIC ACIDS

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Unripe apples, obtained from agrotechnical operations and physiological falls, are not used for food. In particular, in years with insufficient soil moisture, in the orchard about 25-30% of the expected fruit is removed (Peşteanu A. et al., 2018). These fruits are a source of native organic acids. The titratable acidity of those is mostly determined by the presence of malic (70-90%) and citric acids (Bandić L. M. et al., 2019). Natural acidifiers are currently needed in the food industry. Environmental protection has also become a major issue.

In this study was approached the possibility to valorize unripe apples in order to obtain the natural acidifier. Research has focused on determining titratable acidity in unripe apples of 4 varieties: Coredana, Golden Rezistent, Rewena and Reglindis. Other physicochemical indices were also determined. These were picked between June – July 2020. The fruits were harvested during development at 45th, 58th, 71st, 84th and 97th days after the full bloom. The extract was obtained from these fruits and were determined some physicochemical indices. The titratable acidity (expressed in malic acid) in the extracts was determined by titration with NaOH (of 0.1 N). The values of this index decreased on average from 2.80% to 1.50%, depending on the variety. The acidity decreased during the development of the fruits, but the pH values increased non-essential. Total sugar increased considerably as the fruit grew. The dry matter content of the fruits increased continuously for all the apple varieties analyzed. There was a sudden increase in them around the 84th day after full flowering.

Unripe apples represent a source of native organic acids and other valuable substances. The valorisation of these fruits is one of the promising ways to supplement the need for natural acidifiers in the food industry.

Keywords: unripe apples, natural acidifier, organic acid

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THE EFFECT OF DIFFERENT BIOTECHNOLOGIES ON SOME QUALITY CHARACTERISTICS OF AMARANTH (*AMARANTHUS* SPP.) BASED MILK LIKE BEVERAGES

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The objective of the present study was to assess the effect of different biotechnologies on some quality characteristics of amaranth based milk like beverages. Amaranth seeds were subjected to different treatments such as soaking in salt solution for favoring protein availability, germination and malting. The technological process for obtaining the amaranth based milk like beverage involved soaking, fine shredding in water (at 1:4 ratio), thermal treatment and sediment removal. Samples were analyzed in terms of chemical composition, antioxidant activity, CIELAB color characteristics, rheological properties, and colloidal stability at 3rd, 5th, 7th, and 14th days of storage. Also, foaming and emulsifying capacities of obtained beverages was determined. Foaming stability was studied over 30 minutes after obtaining. Milk like samples obtained from seeds soaked in salt presented the highest foaming capacity and stability. The highest value for emulsifying capacity was obtained for beverage based on malted seeds (404 ml oil/100ml sample), followed by germinated (392 ml oil/100 ml sample) and soaked ones (360 ml oil/100ml sample). All obtained milk like samples showed pH values between 6.62 and 6.91, while the acidity ranged from 2.3 °T for sample obtained from soaked seeds to 4.8 °T for the one obtained from malted seeds. Germination and malting increased in vitro antioxidant activity of resulted samples. Rheological properties were determined over small amplitude oscillatory conditions and rotational flow. Results showed a liquid like structure over the entire domain of strain applied, and a shear thinning behavior. Sensorial analyses were performed in order to assess consumers` acceptability of the obtained formulations. In terms of organoleptic acceptance, obtained samples were less appreciated then similar vegetable products (soy and rise based vegetable milk like beverages), implying the necessity of flavoring.

Keywords: amaranth, vegetable milk substitutes, germination, malting

PSYLLIUM USAGE IN REDUCED FAT CONTENT BISCUITS TECHNOLOGY

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The psyllium usage is of great interest for the value-added pastry production due to its functional and physiological characteristics. This raw-material is also characterized with some technological characteristics which will have positively effect on their quality. The aim of the present study is to evaluate the effectiveness of psyllium usage for the reduced fat content biscuits production. In the biscuit`s recipe, 20 and 40 % of fat was replaced with psyllium gel using a combination of psyllium and water (P: W) in the ratio 1: 8, 1:10 and 1:12. All samples were analyzed for moisture content, hardness, density, water absorption ability, spread ratio and sensory characteristics. It was found that the combination of psyllium and water in ratio 1:12 leads to a negative effect on products quality, the denser structure formation compared with the control. The samples with 20 % fat replacement with psyllium (P: W -1:8) and 40 % (P: W -1:10) have showed the best results in all quality parameters – lower density and high overall acceptability. Water absorption ability for these samples increased by 12.0 ... 28.7 %, spread ratio - by 11.3 ... 12.4 %, compared with the control. Thus, the psyllium use provides the consumer characteristics improvement of enriched products and their energy value decrease.

Keywords: psyllium, biscuits, pastry, fat content, quality parameters.

CONTRIBUTION TO THE PROTECTION OF THE TRADITIONAL USES OF THE SPONTANEOUS PLANTS OF CERTAIN LOCALITIES OF THE REGION CASA-BLANCA SETTAT

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Over the past two decades, scientific research has shown that the consequences of malnutrition and micronutrient deficiencies are far greater than previously recognized; even in moderate forms. Changing dietary patterns in turn affects the nutritional status and health status of populations by affecting the diet balance in energy and nutrients. Inadequate intakes of the latter can generate various diseases. Morocco is not exempt from this burden since the prevalence of several micronutrients deficiencies has been reported by several national and regional surveys due to the ongoing nutritional transition. The eating habits have completely changed due to several factors: demographic, economic, technological, urbanization and the transition from a rural to a more sedentary urban lifestyle. These factors, in addition to globalization, have affected agricultural systems and strategies as well as socio-cultural and economic characteristics. The objective of the present work was to inventory the use of wild edible plants in two different populations and examine the relationship between the knowledge of their uses according to several factors: age - sex - place of residence - education level - profession - marital status by an ethnobotanical survey. The Survey conducted in the study area showed that women were the majority involved in the use of wild edible plants, especially for food and cosmetics while men were more involved in medicinal and other uses. The activities of collecting and marketing wild edible plants are in principle shared between men and women. The participants are distributed into nine professions with a majority being housewives (48%) and farmers (40%), as 75% of the surveyed population is rural. The remaining 12% are distributed among the administration, the gendarmes of the region, students of different school levels in the urban area region 25%. 78 species of wild plants were mentioned by the participants aged 41 years old and over. These have had several mode of use in the past and present in the study region (Table 2). On the other hand, only 27 species were mentioned by the age group 17-30 years and 31-40 years. The present work revealed a list of wild food plants used by the population in the study region that will contribute to the documentation of the modes of use (recipes) using an ethnobotanical survey and that can feed food databases and allow the discovery of the plant biodiversity of the Moroccan flora which represents a natural and cultural wealth threatened by its neglect by the scientific community.

Keywords: traditional uses, spontaneous plants, biodiversity, ethnobotanical survey

COMPOSITE DEVELOPMENT OF NATIVE AND DRY HEATING TREATMENT MODIFIED CASSAVA STARCH REINFORCED WITH CLAY

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In the present work, it is proposed to develop and characterize biodegradable composites of native and modified by dry heating treatment cassava starch, reinforced with clay. The composites were obtained by the casting technique using native (NS) and modified cassava starch for 2 h (DHT_2h) and 4 h (DHT_4h) by dry heating treatment (DHT), glycerol and water were used as plasticizers, and 4 different concentrations of sodium bentonite clay (0, 2, 5, and 7) g/100 g starch. The films were characterized for their physical properties (thickness, wettability, solubility and moisture content), mechanical properties (maximum tensile strength, elongation at the break and elastic modulus) and water vapor permeability. A total of 12 different composites were obtained with no deformations, uniform thickness and water content. The starch modification and different concentrations of clay significantly influenced the mechanical properties and water vapor permeability. The composites showed higher tensile strength with increasing clay content (from 11.18 ± 3.76 MPa for NS to 22.00 ± 4.22 MPa for DHT_4h) as well as lower elongation concurrently with the starch treatment time (16.40 ± 6.68 % for NS to 7.61 ± 1.41 for DHT_4h). The reduction in water vapor permeability was registered in the same way ($1.99 \pm 0.54 \times 10^{-9}$ $g \cdot s^{-1} \cdot m^{-1} \cdot Pa^{-1}$ for NS to $1.20 \pm 0.11 \times 10^{-9}$ $g \cdot s^{-1} \cdot m^{-1} \cdot Pa^{-1}$ for DHT_4h). The solubility of the films reduced with the pre-treatment used, but the surface of the films showed a hydrophilic character with contact angle values smaller than 45 °. Composites with modified starch performed better than native one, which also contributed to clay integration in the material polymer chain.

Keywords: biodegradable composites, cassava starch, clay, dry heating

MODIFICATION OF AMINOACID CONTENT OF BREAD USING SPROATED AMARANTH GRAIN

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Bread is a staple food all around the world. *Amaranthus L.* is a promising pseudocereal crop with high protein and lysine content, essential metals, dietary fibre of high quality, squalene, showing different biological activities. Soaking grain followed by its sprouting and disintegration is able to save nutrients, concentrated in seed without removing the seed outer layers. The aim of this research is to study amino acid composition of sprouted amaranth grain and bread made with its application along bread making. Amaranth grain of Kharkivskyi-1 variety grown in Ukraine was used to obtain the sprouted and disintegrated amaranth grain (SDAG), which was soaked for 12–48 hours. The amino acid composition of whole amaranth grain, SDAG and wheat bread made with its 20% of SDAG was determined by the method of ion-exchange liquid chromatography with the analyzer for amino acids T-339 (Mikrotechna, Czech Republic, Prague). Amaranth grain differed significantly in amino acid composition from wheat flour, despite the presence of the same limiting acids of the protein as isoleucine and valine, which were slightly higher for amaranth grain. Unlike wheat flour, only valine, isoleucine and leucine in amaranth grain showed amino acid rates below 50%. Lysine was the dominant amino acid of amaranth grain (85% amino acid score), while for wheat flour it reached only 39%. Due to fermentation occurring in amaranth grain during soaking, in particular, an increase in the activity of proteolytic enzymes in 1.2-1.5 times, SDAG was characterized by an improvement of amino acid score for all essential amino acids in 1.5-2.7 times. Additionally, the amino acid composition of bread was characterized by an increase in the scores of all essential amino acids, but for wheat bread lysine remained a limiting amino acid (62% score) in contrast to the wheat-SDAG bread with 20% SDAG, the lysine content was higher in 2.4 times in comparison to the wheat bread. All essential amino acids of the wheat-SDAG bread had a 133-213% score, which led to a significant improvement in the amino acid composition of the protein. Moreover, the wheat-SDAG bread contained in 1.7 and 1.6 times more essential and non-essential amino acids respectively. All in all, amino acid content of amaranth grain and wheat bread with 20% SDAG was essentially improved by the grain bioactivation.

Keywords: amaranth grain, soaking, bread, disintegration, amino acid content

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WILD EDIBLE PLANTS BETWEEN VALORIZATION AND NEGLECT IN TWO DIFFERENT TYPES OF POPULATION: URBAN AND RURAL OF THE REGION CASA BLANCA SETTAT

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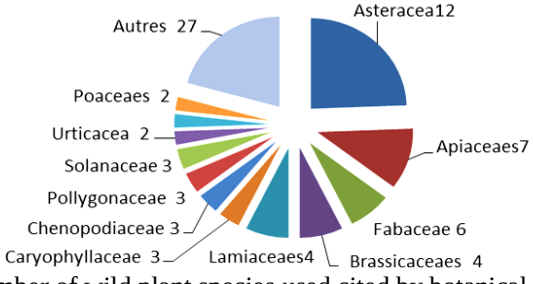
The reason for choosing the pure topic is that today, issues of population nutrition and health still dominate the global landscape on a large scale given that eating habits have changed completely, due to several factors. This change affects the food balance in terms of energy and nutrient intakes. This development testifies the nutritional transition, a phenomenon that can also cause natural imbalances that affect environment and development sustainability in a negative way. This is despite that the studied local diet is of Mediterranean type recognized as one of the reference dietary models. By the World Health Organizations that also protects local biodiversity and respects seasonality. Wild food plants are part of this diet and biodiversity. Their consumption can meet the nutritional needs of the population and treat problems of malnutrition and problems of nutritional imbalance. The objective of this work is to document these spontaneous plants in a survey population and discover the plant biodiversity of the study area. The results of this research contribute to documenting use patterns with the help of ethnobotanical surveys of these plants in the study area. A total of 49 recipes was cited including 21 recipes for food use, 7 for medicinal use, 14 for both food and medicinal uses, and 4 recipes for food and other uses. And 4 recipes for food and other uses. Only one recipe for each of the following uses: food/medicinal/cosmetic use, other use, food/medicinal use and other use were identified in the study locations. A total of 78 plant species belonging to 36 families were identified, only those plant species representing a description of use or recipe were considered. This latter can nourish food databases and allow the discovery of biodiversity of Moroccan plants, which represent a wealth that is currently threatened and found neglected by the scientific community.



Number of wild plant species used cited by botanical family

Keywords: Wild edible plant, ethno botanical surveys, biodiversity, malnutrition

METABOLIC DISORDERS AND INADEQUATE DIETARY ENERGY INTAKE IN PATIENTS ON HEMODIALYSIS

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Introduction & Background: Metabolic syndrome (MetS) is a cluster of cardiovascular risk factors, that has been well demonstrated to increase the risk of cardiovascular disease and mortality in hemodialysis (HD) patients. Dietary energy intake (EI) is considered as an important nutritional approach to prevent MetS. The goal of this study was to assess the prevalence of MetS in HD patients, and to evaluate the association between daily energy intake with metabolic abnormalities and MetS among HD patients.

Methods: A total of 157 HD patients were included in this prospective study. The dietary intake was assessed using two 24-hour dietary recalls, demographic, anthropometric, clinical and biochemical data were also analyzed. The frequency of MetS was diagnosed using the National Cholesterol Education Program Adults Treatment Panel III (NCEP-ATP III) criteria. The cut-off values of daily EI were 30 kcal/kg for patients aged 60 years and above and 35 kcal/kg for those aged less than 60 years.

Results: The results report a prevalence of 22.7% for MetS and 60% for inadequate EI A significant association of inadequate EI with higher prevalence of elevated waist circumference, overweight or obesity and with high total cholesterol levels was disclosed among 60% of the study sample. Furthermore, inadequate EI was associated with higher proportion of metabolic abnormalities and MetS ($p < 0.05$) in this population.

Conclusion: MetS is prevalent among HD patients and it is associated with more comorbidities and more inadequate daily energy intake. Promoting adequate nutritional approach could help to improve dialysis quality and prevent the negative effects of metabolic disorders, and hence improve the quality of life of HD patients.

Keywords: hemodialysis patients, metabolic syndrome, inadequate dietary energy intake, cardiovascular disease, NCEP-ATP III.

COMPARISON OF THE FOOD PYRAMID OF AN ADULT MOROCCAN POPULATION WITH THE RECOMMENDATIONS OF THE PYRAMID OF THE MEDITERRANEAN DIET UPDATE

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One of the illustrations chosen for the presentation of the nutritional recommendations of the Mediterranean diet (DM), is the food pyramid (PA). The aim of this work is to design a food pyramid illustrating the food model, the lifestyle and friendliness habits of an adult Moroccan population and compare it to the recommendations of the Pyramid of the traditional Mediterranean diet updated in 2020 by a group of experts. Our study was conducted in 2018 in 507 adult subjects from the Rabat-Salé-Kenitra region of Morocco.

Information on socio-demographic characteristics, friendliness and toxic habits were collected through a questionnaire; physical activity was assessed through the Marshal questionnaire; data on nutritional intakes and food diversity were collected by a food-history-type survey; and the food variety was determined by a food frequency. The majority of the study population was over 34 years of age (59%), lived in urban areas (70%), female (52%), 31% still took part in the preparation of meals in the household, took at least two meals a day as a family (48.9%), sufficiently active (57%) and had no toxic habits (99.9%). Energy and protein intakes exceeded recommended intakes ($p<0.001$); while dietary fibre and water intakes were deficient ($p<0.001$). The BP designed on the basis of the food consumption of our population consists of seven levels comprising from the base to the top, 1) water intake, 2) cereals and starches, 3) sugars and sweet products, 4) fruits and vegetables, 5) dairy products, 6) olive oil, and 7) pulses, nuts, red meat, fish, chicken, eggs and olives. This hierarchy, as well as the frequency of consumption of certain foods and food groups different from the recommendations of the PDM, reflects a non-sustainable diet.

Keywords: food pyramid, mediterranean diet, food diversity, food variety, lifestyle, friendliness, nutritional recommendations

QUALITY INDICES OF WINE BRANDIES IN DEPENDENCE OF DISTILLATION METHODS USED

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Technological distillation is a process by which a low proof alcoholic beverage is heated in a controlled process in order to separate ethanol from water and other components, with the ultimate goal of concentrating the ethanol into a high proof spirit. The raw material used in the production of the distillate is the technological wine produced through a special technological scheme and the observance of some technological requirements included in the national document SM: 186-2014. The general process by which brandy is obtained from grapes includes the main processes such as: grape → fermentation directly → submerged fermentation with pure culture of yeast → liquid-state distillation → aging in oak barrels.

So, the research has shown that using different distillation methods has a major impact on the wine distillate quality and as a result, according to the study, the quality of the wine distillate obtained based on the discontinuous installation Charente has a higher level than that obtained at the continuous installation VAND-M-01. The physical-chemical indices of the raw material wines destined for distillation fit within the acceptable limits established by the technical conditions. Therefore, in order to improve the quality of the obtained wine distillates, it is essential to make an appropriate choice of the distillation methods and working parameters that need to be used during the wine distillate production.

As a consequence, the quality of the wine distillate using the *Charente* method was identified as being of a higher level than those produced by using VAND-M-01. This result is owing to the fact that by utilizing the VAND-M-01 method, the volatile acidity increases approximately by 6 times and produces wine distillate with a slightly quality downgrade. So, the number of aldehydes obtained by distillation with ordinary installations was 0.11 g/dm^3, and in a continuous flow 0.05 g/dm^3. The reasons for such experimental data are due to the fact that the distillation process in the first case took longer than was expected and some of the alcohol oxidized due to aldehydes. Moreover, it was established that the higher alcohol content in the distillates that were initially obtained by both methods Charente (3.10 g/dm^3) and VAND-M-01 (2.78 g/dm^3) correspond to the acceptable limits between 1 and 6 g/dm^3).

The composition of volatile components in the heart fractions of wine distillates varied greatly depending on the distillation methodology used, on the separation of the head fractions from the heart and on the final concentration of alcohol in the heart fractions. Increases in the alcohol by volume strength of the heart fractions (from 65

to 75% vol.) resulted in a gradual reduction in the concentrations of volatile compounds such as aldehydes, esters and higher alcohols, as well as in lower levels of methanol, furfural, anhydrous alcohol and acetaldehyde.

Keywords: aroma compounds, distillation methods, grape varieties, physico-chemical indices, wine distillates

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, Department of Oenology and Chemistry, Microwinery Center.

OXIDATION OF AROMATIC WHITE WINES UNDER THE INFLUENCE OF CONTROLLABLE TECHNOLOGICAL FACTORS

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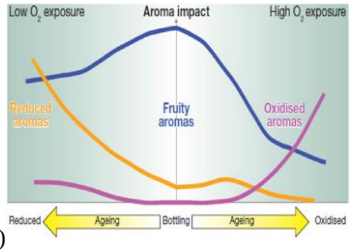
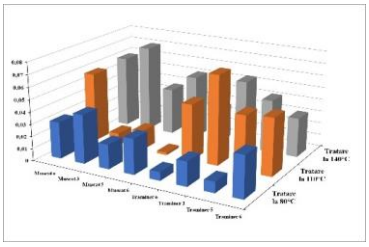
Wine oxidation is one of the major problems of wine. Recently, it has been reported that up to 48% of qualified wines being defected by juries at wine competitions have presented aromas that can be related to their oxidation throughout the technological process. Of all the gases that can be dissolved in wine, oxygen and carbon dioxide can be considered the most important. Oxygen must be considered as a highly reactive chemical agent that has the potential to modify wine by oxidation (figure 1 a). Different oxygen levels can have a great influence on the color, aroma, aromas and general perception of the wine. The total oxygen absorption capacity is 80 mg/l for white wines and 800 mg /l for red wines.



a)



b)

Figure 1. Description of effects: a) results of oxygen exposure on the aroma of bottled wine and b) the coloring intensity for the wine samples experimentally oxidized with Iron and Copper ions at different thermal regimes

In laboratory conditions, by monitoring the oxidation processes throughout the technological process 2 dry white aromatic quality wines were developed. In the dynamics, a series of analyzes on the grapes, must and wine obtained, such as: physico-chemical indices, specific indices (pH, oxidability; 420 nm absorption; antioxidant capacity, Pom test) were performed.

Generalizing the results of the experimental and applied presented study, it is revealed that the decomposition rates of oxygen in wines described a good correlation with the total concentration of exogenous copper and iron in the wine samples, both for total and residual concentrations compared to decomposition oxygen rates. In summary, it can be noted that the results obtained from this research are the first to show the influence of the administered concentration of exogenous copper and iron species in dry white wines.

Keywords: aroma compounds, physico-chemical indices, technological process, white wine

Acknowledgment: The research was funded in the framework of State Project 20.80009.500727 "Physico-chemical mechanisms of redox processes with electron transfer involved in vital, technological and environmental systems", running at Technical University of Moldova, Department of Oenology and Chemistry, Microwinery Center.

A PRELIMINARY STUDY ON MACRONUTRIENTS BALANCE AND MICRONUTRIENTS AMOUNTS IN CHILDREN'S

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Due to the rapid rate of growth and development during the first two years of life, nutrient needs are higher. Children should consume a variety of nutritious foods rich in both macronutrients (proteins, lipids, carbohydrates) and micronutrients (vitamins and minerals). The aim of this study is to analyze the balance between macronutrients and the level of some important micronutrients in the health of young children (calcium and iron).

Data was collected using the food journal method, thus the daily menu of five children aged 12-24 months was analyzed for 5 consecutive days. The results showed the following: the children received low-calorie menus compared to the recommended daily requirement of 779 kcal (on average ranging from 542 to 745 kcal); protein levels were high, on average up to 195% more than the recommended daily amount of 14.7 g / day: the diet was often balanced in terms of carbohydrates intake (from 48.4% to 55.8% of daily caloric intake); micronutrients, Fe and Ca from solid foods, were below the recommended daily allowance.

In conclusion, the analyzed menus showed a diversified diet, but mostly low in calories, high in proteins, balanced in carbohydrates and low in lipids, reduced in iron and calcium.

Keywords: diet, solid foods, micronutrients, macronutrients, malnutrition

EATING BEHAVIOR OF CHILDREN FROM 6 MONTH TO 3 YEARS

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Nutrition is essential in the rapid and healthy development of the child. A balanced diet, in the first years of life, will help establish a basis for healthy eating habits.

The aim of this study was to analyze the eating behavior of children from 6 months to 3 years. The data was collected through a questionnaire, that involved 510 respondents. The study followed if, depending on age, children eat enough solids, what foods they prefer and how balanced their daily plate is, but also, the behavior and choices of parents, regarding the child's diet: if they are preoccupied with the type of foods their children eat (organic, conventional or traditional foods); if they introduce solid foods earlier than 6 months; if they have deliberately excluded certain foods from their children's diets. The frequency with which new foods were introduced was also followed. The results of the opinion poll showed the following: more than a third (36%) of mothers chose to breastfeed even after the age of 1 year; the majority (88%) of children started eating solid foods after the age of 6 months; only 12% of children started eating solid foods before 6 months and 8.4% of them started earlier than 6 months on the doctor's advice; about 90% of parents opted for the classical method of introducing solid foods ; 66% of parents chose organic food as food for their children; fruits and vegetables are found in children's food: 85% of children consume 1-2 servings of fruit daily, 90% of children consume 1-3 servings of vegetables daily; 83% of children consume meat more than 3-4 times a week and 65% of children consume a portion of cereals or cereal products daily. Most mothers (72%) introduced a new food 2-3 days apart, being aware of current recommendations and about 80% of children did not show any reactions and tolerated well all foods with potential allergens.

In conclusion, over half (69%) of the children who participated in the study consumed daily from all five food groups, having a balanced menu.

Keywords: nutrition, solid foods, children 6 months-3 years, eating behavior

ROMANIAN TEENAGERS' KNOWLEDGE, ATTITUDE AND PRACTICE ON HEALTHY NUTRITION AND WELLBEING

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This research aimed at establishing the relationship between nutrition knowledge, food choice attitude and nutrition & wellbeing practice among Romanian teenagers.

The study used data from an online survey applied on 343 high-school teenagers in November 2020, representing 55% of the total students from Colegiul Dobrogean "Spiru Haret" -Tulcea, Romania, ranging from first year of high-school up to the 4th, from all four specialties (Mathematics- Informatics, Nature Sciences, Philology, Social Sciences).

A questionnaire of 28 items was designed by using the Food and Agriculture Organisation of the United Nations guidelines for assesing nutrition- related knowledge, attitude and practices (KAP) (Macías & Glasauer, 2014).

The Main Component Analyses using three principal components (PC) and Varimax rotation method indicated the factors influencing **emotional eating** for teenagers: the first PC is mostly associated with reducing stress and negative emotions, the second PC is mostly influenced by tuning the food related behaviour and hormones, while the third component is mostly related to sweets and fats consumption. The teenagers consider that **wellbeing** is firstly influenced by friends, family, secondly by their weight status, physical aspect, grades, spa treatments, movies and thirdly by sports and food consumption.

Mathematical modelling of the results with IBM SPSS- AMOS v. 26 software revealed significant correlations between knowledge on nutrients, understanding of food pyramid with the nutritional status of the 343 teenagers: $\chi 2 = 2.19$; GFI= 9.25; AGFI=9.01; CFI= 9.13.

The model obtained indicates that the better the knowledge on nutrient sources and food pyramid is, the better the nutritional status of the analyzed teenagers is.

The results of this study were used for designing an intervention plan that was presented as a management developing project by the educational managers of Colegiul Dobrogean "Spiru Haret" -Tulcea, Romania.

DIETARY BEHAVIOUR OF THE PREGNANT WOMAN

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Nutrition during pregnancy is one of the main concerns of women today, aware of the importance of healthy nutrition on the development of the child. One of the most important aspects for ensuring the health of mothers and babies is the nutrition that corresponds to the specific coverage of needs. Recommended foods during pregnancy are actually indicated during breastfeeding and can represent a healthy lifestyle after that.

The aim of the study was to analyze the eating behavior of pregnant women. It was also looked at whether food preferences ensure the need for essential micronutrients, iodine and iron. The data were collected through a structured online questionnaire that was completed by pregnant women in Galati County who attend pilates, yoga and aerobics classes.

The questionnaire contains 23 questions and the number of respondents was 75. This was done with google forms and the resulting data was processed computerized with google forms. The results of the opinion poll showed a very large number of lost pregnancies (28.8%); some women say they have problems with the thyroid gland (18.7%); only 6.7% of women say that, on the doctor's recommendation, they used potassium iodide in the last month of pregnancy and 58.7% used iron supplements in the last 3 months of pregnancy. The pregnant woman's diet is slightly unbalanced in quality, so 12% of women consume milk and dairy products less than once a week or not at all; fish is not part of the food preferences of pregnant women surveyed, being consumed by most of them once a week (42.7%); the egg is consumed by most pregnant women 2-3 times a week (45.3%); a large part of the women surveyed consume cereal products daily (73.3%). In conclusion, the pregnant woman's diet can be improved through balanced nutrition and supplements recommended by the doctor to give birth to a healthy baby.

Keywords: food, nutrition, pregnant women, iodine, iron

WEIGHT LOSS AFTER PREGNANCY THROUGH DIET COMBINED WITH PHYSICAL ACTIVITY - A CASE STUDY

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Motherhood changes a woman's body both inside and out. Body weight and shape, but also general well-being can be improved through diet and physical activity. Aware of the importance of healthy nutrition on the child's development, nutrition during pregnancy is one of the main concerns of women today.

The study aims to assess the extent to which the combination of diet and exercise helps women to return easily and quickly to pre-pregnancy joint weight and mobility. The study lasted 90 days and had as its subject a new mother with substantial postpartum weight retention, who set out to return to pre-pregnancy forms in the shortest possible time.

The meal and physical activity programs were correlated with the breastfeeding program and daily activities, and the rest time was 7-8 hours / day. She opted for a healthy diet so as to benefit from all the macronutrients and micronutrients she needs. The amount of liquids consumed was at least 2.6 liters / day, of which water was at least 1.5 liters and the rest representing fresh, soups and teas. The physical activity programs consisted of physical exercises performed only with body weight, in short series, with breaks for hydration and rest, followed by massage. At the end of the program there was a loss of excess weight, an increase in joint mobility, an improvement in muscle tone and skin elasticity, as well as a positive mental state of happiness and fulfillment. In conclusion, for any woman it is very important to take care of her physical appearance after giving birth and exercise and a healthy diet is the solution. The results clearly support the need to develop programs that promote the importance of diet and physical activity in the physical and emotional health of women after pregnancy.

Keywords: post-pregnancy, weight, diet, postnatal health

EFFECT OF PH AND PECTIN ON NANOEMULSIONS STABILIZED BY SODIUM CASEINATE: COLLOIDAL STABILITY AND LIPID OXIDATION

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Protein stabilized emulsions are excellent systems able to provide protection and controlled release of nutrients and active molecules in the food products, but instability under certain conditions limits their further applications. Adding stabilizers is an effective method to improve the stability of these emulsions. Many plant polysaccharides can be used to this purpose due to their thickening effects but also to their adsorbent properties. Therefore, in the present study, the effect of different concentrations of low methoxyl pectin (LMP) on the physical and oxidization stability of sodium caseinate (CAS) stabilized nanoemulsions under different pHs was investigated. In particular, we determined the adsorption conditions of LMP on CAS stabilized emulsions, and the effects of adsorbed and free pectin on the stability and oxidation of the emulsion, respectively. These results could facilitate the application of polysaccharides as multifunctional ingredients in protein stabilized nanoemulsions over a wide range of pH values.

Keywords: sodium caseinate, pectin, nanoemulsion stability, lipid oxidation, pH

PLANT BASED DIETS: ARE SUPPLEMENTS A NECESSITY FOR AN ADEQUATE NUTRITION?!

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Plant based (vegan) diet, which excludes all animal products, has become increasingly popular in recent years due to its many positive effects. They include sanogenetic consequences, like the prevention of chronic degenerative diseases, by excluding food components that are risk factors, but also consequences on the environment, on which the impact of plant food production is much milder than that of animal production. In this context, all the necessary nutrients have to be provided from plant sources and there is an eventuality of requiring a personalized administration of mineral-vitamin supplements, where food fails to cover the daily metabolic needs. Studies have shown that an exclusively plant-based diet does not contain the required amounts of vitamin B12; Consequently, any person adopting this style of eating, regardless of age or sex, should preferably supplement orally in quantities that exceed the limiting absorption mechanisms that involve an adequate synthesis of intrinsic factor. All other vitamins and minerals can be brought from plant sources but, depending on individual needs, supplementation with vitamin D and calcium might be indicated (especially in children, pregnant women, people living in the northern hemisphere, elderly adults), as well as with iodine (in areas naturally poor in it), zinc (especially in children), etc. A physiological alternative is the use of fortified foods (vegetable drinks being the most popular), an area in which the development of new products is expected with great interest. In conclusion, vegan eating is a sustainable type of diet but requires initial dietary advice.

It is also a challenge for those working in the field of new food technologies, who are called upon to develop nutritionally appropriate products, which bring all the necessary nutrients in an adequate amount, so that any additional supplementation becomes redundant.

Keywords: vegan, plant based, food supplements, food fortification

Acknowledgment: This study was achieved through Core Program, with the support of the Ministry of Research and Innovation (MCI), contract 22N/2019, project PN 19 02 01 02.

FOOD SAFETY IN A PANDEMIC WORLD SESSION

TOWARDS RECOMBINANT PRODUCTION OF BACTERIOCINS USING *CORYNEBACTERIUM GLUTAMICUM*

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No provided due to legal restrictions by consortium and grant agreements.

Keywords: *Corynebacterium glutamicum*, bacteriocin, nisin, pediocin, recombinant production

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INNOVATION STRATEGIES OF FUNCTIONAL PLANT MILK PRODUCTION BASED ON HEMP (*CANNABIS SATIVA L.)* SEEDS

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Plant-based milk is a popular product not only for vegans, but also for people with lactose intolerance. Today on the shelves you can find a huge selection of analogs - soy milk, almond, coconut, oatmeal or even rice. But the main question remains whether it can replace cow's milk and which one to give preference to. Having carried out a comparative analysis of the most popular types of plant milk with cow milk, it was established that no plant milk even compares with cow's milk in terms of vitamins and minerals, especially of protein and calcium content, the most important milk nutriments.

The technology of functional plant-milk has been developed based on hemp (*Cannabis sativa* L.) seeds of local origin. The high nutritional value and potential functionality of this local raw material were proved by the presence of a significant amount of polyphenols (295 ± 7 μg • ml-1) and tannins (4.25 ± 0.54%) in it. UV/VIS spectra analysis showed that the seeds contain various groups of flavones and flavonoids, the antioxidant activity being more than 88%. *Cannabis sativa* L. seeds stand out from other species in the low content of sugar (5.71 ± 0.01%), high protein potential (25.33 ± 0.13%), and a good mineral composition.

As a result of physicochemical studies of the developed plant milk, it was revealed that hemp seed milk contains a large amount of flavones, in particular quercetin, cyanidin and epicatechin. It was found that the protein content in such milk is 8 times higher than in classic oat or rice milk, more precisely 4,68 g / 100 g. This amount is similar to the protein content of cow's milk. It was determined that the acidity level, as well as other quality indicators are in accordance with the regulatory documents permissible limits - 19 ± 1ºT, and pH - 6.17 ± 0.01. It was found that the organoleptic characteristics of plant milk based on hemp seeds were highly appreciated by adherents of vegan nutrition.

Keywords: plant milk, local raw material, functional properties, hemp seeds, high protein content

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.

LACTOSE FREE YOGURT TECHNOLOGY DEVELOPMENT FOR PERSONALIZED NUTRITION

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Due to the widespread use of antibiotics, the bad ecological situation, fermented milk drinks are gaining more and more popularity. Yoghurts are especially popular among the population. Fermented milk products contain a unique in its kind disaccharide of animal origin lactose, which has the ability to stimulate the development of lactic acid microorganisms that suppress the vital activity of pathogenic microflora in the human intestine, promoting the absorption of calcium, magnesium and phosphorus.

A significant part of the world's population suffers from lactose intolerance, linked to a genetically determined deficiency of the enzyme β-galactose, which is one of the main reasons for the decrease in demand for dairy products among consumers suffering from primary or acquired intolerance to milk sugar.

Lactase deficiency is a variant of fermentopathy caused by the inability to break down lactose, a natural disaccharide contained in dairy products due to a decrease in the activity of the enzyme of parietal digestion in the small intestine - lactase. Lactose intolerance in the gastrointestinal tract of a person suffering from hypo- and alactasia leads to dispersion, diarrhea and other undesirable phenomena. For the successful prevention and treatment of these diseases, it is necessary to reduce or completely eliminate the lactose intake.

A technology for lactose-free milk producing was developed using fermentation technology. On the basis of lactose-free milk, a range of lactose-free yoghurts was developed: of animal and vegetable origin of the following types: natural, fortified and with additives. Flax seeds, sesame seeds and chia seeds, which are rich in vitamins, were used to produce a range of yogurt with additives. To obtain fortified yoghurts, the minerals iron and calcium were used, which prevent the development of anemia and oncological pathologies. Experimental assortment of lactose-free yoghurts was assessed by physicochemical and organoleptic methods. All developed samples meet the standards of technical documentation for this type of food product. The organoleptic characteristics were highly appreciated. Developed lactose-free products are an opportunity for many people to return to a normal healthy diet.

Keywords: intolerance, fermented milk products, lactose free, fermentation technology, healthy diet

Acknowledgment: The research was funded by State Project 20.80009.5107.10, nr. PS-62 "Personalized nutrition and intelligent technologies for my well-being", running at Technical University of Moldova.

ANTIMICROBIAL ACTIVITY OF SEA BUCKTHORN AND CHOKEBERRY POWDERS ON PATHOGENIC BACTERIA

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The problem of providing consumers with safe and healthy food is very current. In order to reduce the degree of food microbial contamination, antimicrobial activity, minimum inhibitory concentrations (MIC) and minimum bactericidal concentrations (MBC) of sea buckthorn (*Hippophae rhamnoides* L.) and chokeberry powders (*Aronia melanocarpa*) against the pathogenic microorganisms *Staphylococcus aureus*, *Escherichia coli* and *Klebsiella pneumoniae*. In addition, the total content of carotenoids, polyphenols and antioxidant activity by the DPPH test were determined. Following the tests performed, it was found that the vegetable powders performed an antimicrobial activity of different levels against all the pathogenic microorganisms investigated. Sea buckthorn powder had a more pronounced antimicrobial activity to pathogenic microorganisms than chokeberry powder. The diameter of the inhibition zone was 22 mm for *S. aureus*, 18 mm for *E. coli* and 17 mm for *K. pneumoniae*. In the case of chokeberry powder, the antimicrobial activity was reduced 2.2 times compared to *S. aureus*, 2.6 times compared to *E. coli* and 2.4 times - *K. pneumoniae*. The antimicrobial potential of vegetable powders is probably attributed to the of polyphenolic compounds content, especially quercetin and gallic acid derivatives. Gallic acid can change bacterial hydrophobicity, while quercetin leads to bacteriostasis by damaging cell walls and membranes. MIC and MBC of sea buckthorn and chokeberry powders on the studied pathogenic microorganisms were determined. It was shown, *S. aureus* have an important sensitivity to all the powders studied. Sea buckthorn powder had the lowest MIC and MBC, the values being 1.95 mg/mL and 3.90 mg/mL respectively, and chokeberry powder had the highest MIC and MBC, 15.63 mg/mL and 31.25 mg/mL, respectively. *E. coli* and *K. pneumoniae* were resistant to chokeberry powder. The sensitivity of pathogenic microorganisms to vegetable powders may be due to the structure of the cell wall and outer membrane. Thus, sea buckthorn and chokeberry powders have demonstrated an important antimicrobial potential on some pathogenic microorganisms studied and can be used in the food industry to reduce the degree of food microbial contamination.

Keywords: antimicrobial activity, sea buckthorn, chokeberry, pathogenic bacteria

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THE ZOONOTIC DISEASE BETWEEN HUMANS AND COLD-BLOODED ANIMALS (FISH AND REPTILES)

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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. Infections such as *Salmonella, Mycobacterium, Chlamydophila, Aeromonas* and *Pseudomonas* are also very important among common bacterial diseases. Fungal* infections include Aspergillus, *Candida, Cryptococcosis, Chrysosporium*-related fungi, and other fungal agents. *Cryptosporidium* and *Purosphalus* 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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FOODBORNE ZOONOTIC BACTERIA IN FISH AND PREVENTION WAYS

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Purpose: Aquaculture around the world has grown dramatically in recent decades, but food safety is one of the most controversial issues in various studies. Therefore, familiarity with the foodborne zoonotic factors because of the migration microorganisms to the human is essential.

Result: The present study has performed to collect information about the most important causes of fish zoonosis, bacteria. Bacteria are divided into two groups, gram-positive and gram-negative, which are usually found in the digestive tract of fish. Studies have shown that some pathogens of zoonosis do not cause disease in aquatic animals, so the study of their interactions between humans and aquatic species is complex. But fish, as seemingly healthy carriers can transmit the pathogen to humans. In addition, commensal microorganisms could become foodborne zoonotic pathogens with fewer problems for aquatics. Moreover, many of the clinical signs of the disease in aquatic species are not deeply related to the clinical signs in human. However, human infections transmitted from fish are associated with contact and the immune system of the person. The most important ways to prevent food-borne zoonotic diseases are cooking well and staff teaching.

Conclusion: However, due to the development of aquaculture, the increase of emerging microorganisms and the presence of foodborne zoonotic bacteria in fish, awareness of these microorganisms and clinical signs of fish is essential to minimize the risk of transmission to human.

Keywords: fish, foodborne, zoonotic, bacteria, prevention

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FROM SHOP TO FORK: SIMILARITIES AND DIFFERENCES IN FOOD SAFETY ROUTINES APPLIED BY EUROPEAN CONSUMERS

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Aiming to reduce the number of domestic foodborne disease cases, a study of food safety routines applied by European consumers from shop to fork was conducted in the SafeConsume project. The fieldwork performed by teams of sociologists, food microbiologists, and food safety specialists, which started in food stores (supermarkets, groceries, open markets), continued on the move (walkways, private cars, public transport) and ended in homes with a cooking session and examination of storage conditions, combined on-site observational and conversational methods. A number of 87 households from France, Hungary, Portugal, Romania, Norway and UK belonging to consumers at risk (elderly people, and young families with children or pregnant women) and risk takers (young single men) were under the specialists' attention.

When shopping, there were consumers who selected food products in accordance with the shop layout and organization (mostly in Romania, France and the UK), while other participants displayed awareness of the importance of maintaining the cold chain and prioritized getting the dry foods first and the frozen, fresh and chilled products last.

It was common routine for Norwegians to wash or rinse their hands when handling chicken, while French and Romanians did the same in a lesser extent, and mostly to get rid of grease than of pathogens. *Campylobacter* and *Salmonella* were mainly spread on the cutting boards (23% contaminated after chicken preparation), while the contamination events of sponges, handles and sinks were rare. Using the same cutting board and knife between handling raw chicken and salad without washing with soap and water was common in Portugal and Romania, but not in the other countries. The participants' awareness of the risk posed by pathogens from raw chicken differed among the six countries, with higher awareness in Norway and the UK.

Consumers' routines for monitoring temperature were also investigated and tactile sense proved to be often used. This could expose consumers to risky situation due to misevaluation of refrigerated food and surfaces real temperature. All the observational and experimental work regarding food refrigeration indicated the necessity for better monitoring of cold food chain at domestic level.

The research aimed to contribute to a better understanding of the differences and similarities between Southern, Northern, Western and Eastern European food cultures in relation to food safety.

Keywords: hands, cross-contamination, pathogens, refrigeration, *Campylobacter*, *Salmonella*

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EVALUATION OF *SALMONELLA* BACTERIA ISOLATED FROM MEALWORM POWDER FOR FISH FOOD

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This study was performed to evaluate the dry mealworm (*Tenebrio molitor*) to evaluate the contamination of Salmonella, which are among the most important food bacteria. Over the years, many studies have shown an increasing interest in using insect meal in animal feed. Mealworms are the larval form of the mealworm beetle, *Tenebrio molitor*, a species of darkling beetle. Like all holometabolic insects, they go through four life stages: egg, larva, pupa, and adult. Larvae typically measure about 2.5 cm or more, whereas adults are generally between 1.25 and 1.8 cm in length. Salmonella has been found in fish, and many foods which is an important factor in the pathogenesis of food, apparently mealworms (*Tenebrio molitor*) for feed and food have not been reported. This importance prevents the entry of *Salmonella* to produce shows, for example, the substrate contaminated order to prevent the larvae of *Salmonella* positive because they are at least 14 days Positive remained (except at the lowest level of contamination). *Enterobacteriaceae* family is a group of bacteria that are very representative of *T. molitor* larvae and although *Salmonella* spp. It is family owned and is still alive no findings of salmonella have been reported. To register the absence of Salmonella spp. mealworms were tested for the presence of Salmonella quality. Pre-enrichment of 10 g or 25 g samples are commonly used. A colony from a plate player overnight (o.n.) tryptic soy agar with sheep blood on (TSASB) to 10 ml buffered peptone water (CM1049, Oxoid, DK) and incubation was moved. At 37 °C. A series of dilution of 10 times o.n. Culture to achieve the expected contamination levels of about 2 to 7 log CFU / g, in a solution of NaCl 0.9% were prepared to determine the exact concentration of ST, 0.1 ml of each dilution was spread on TSASB. If samples test negative, less than the detection limit of 1 or 2 log CFU / g, a zero value was applied to calculate the average. The ST in the larvae in all three samples below detection level was a little (Table 3 as <1 or <2 CFU / g log shown) from now on the first day of the larvae exposed to pollution levels 1.7. However, the level of salmonella contamination is also of interest because the dose-response of *Salmonella* using data from outbreaks show that the risk of infection and disease caused by infection with dose increases.

Keywords: Mealworm, fish food, *Salmonella*

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FOOD SECURITY IN MOROCCO IN THE COVID-19 PANDEMIC ERA

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Introduction: The onset of the COVID-19 pandemic due to corona virus has significantly affected the lifestyles of different populations internationally. Indeed, the containment imposed by the authorities of the different countries to fight against the spread of this pandemic, induced a change in the food level in terms of availability, supply, preparation and satisfaction. This has affected household lifestyles and food security, compounded by stress, fear of the unknown and lack of visibility into the future.

Objective: The purpose of this work was to provide a comprehensive overview of food security in Morocco during the COVID-19 pandemic.

Materials and methods: This work was carried out among 947 Moroccan adults, through a questionnaire published online, from May to August 2020.

Results: The results show that 39.5% of respondents were in food security compared to 60.5% in food insecurity divided into light food insecurity (44.6%), moderate food insecurity (14.1%) and severe food insecurity (1.8%).

Conclusion: Food insecurity as a whole, continues to be a significant challenge for developing countries, especially in Morocco. This requires a rigorous reflection to better manage the impact of this pandemic situation on food security and also to propose measures to be put in place for the future.

Keywords: food security, COVID-19, food, lifestyles

Acknowledgment: I thank all the participants and the research team for the success of this study.

NATURAL ANTIMICROBIAL COMPOUNDS` EFFECT ON *LISTERIA SPP.* BIOFILM – A REVIEW

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The inhibitory effect of a large number of natural antimicrobial compounds on the biofilm-forming ability of *Listeria* spp. was intensively studied, based on the fact that these Gram-positive bacteria are a particular concern for the food industry. For a maximum efficiency of the natural antimicrobial agents, during biofilm formation, the bacterial adhesion stage should be considered, taking into account that, at this step, the cells are very unstable and less resistant. The treatment with nisin, the only bacteriocin allowed as food additive, has been extensively assessed. Some studies showed that *Listeria monocytogenes* can develop resistance to this antimicrobial peptide. Thus, novel bioactive compounds were tested and proposed as anti-biofilm agents not only for *Listeria monocytogenes*, but also for other Gram-positive and Gram-negative bacteria. Luteolin is a bioflavonoid which was described as a potential food preservative and a surface disinfectant, acting on the cell membrane level and altering the morphology of the bacteria found in the planktonic state. Glycinin basic peptide (GBP) is a 20 kDa natural peptide derived from the 11S subunit of glycinin, that exhibits anti-listeria activity by neutralizing the cellular membrane surface through electrostatic interaction. The bacterial death occurs due to the inhibition of the Embden–Meyerhof–Parnas (EMP) pathway, with negative consequences for the DNA synthesis. Furthermore, it was shown that the bacteriocins from class IIa, synthetized by *Enterococcus faecium* and *Enterococcus faecalis*, not only inhibit the biofilm formation but also reduce the *Listeria* spp. biofilm mass. Expression of *Listeria monocytogenes* virulence genes (*sig*B, *inl*A, *inl*C, *prf*A, *act*A) is affected by quercetin treatment, resulting in decreased cells' adhesion and biofilm formation.

Keywords: *Listeria monocytogenes*, anti-listeria compounds, food safety, biofilm prevention

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PLANT EXTRACTS AS INHIBITORS OF FOODBORNE PATHOGENIC BACTERIA

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The CDC estimates that 48 million people get foodborne illness each year, 128,000 are hospitalized and 3,000 die (CDC).

Many strategies were used to inhibit the growth of undesirable microorganisms, usually by using chemical agents that exhibit antimicrobial activity.

Due to rapid development of microbial resistance against chemotherapeutic agents (mostly antibiotics), it has become essential currently to screen effective, safe, cheap, and available therapeutics from various medicinal plants like berries for their potential antimicrobial effect. Our study was conducted to investigate the efficacy of several berry extracts against a range of food-borne pathogens. The antibacterial activities were investigated against various Gram-negative and Gram-positive foodborne pathogens. To establish the antimicrobial activity of plants extracts, the following *in vitro* methods were used: well diffusion method (qualitative), successive dilutions (quantitative) and the spectrophotometric method. As natural preparations with bacteriostatic effect were used: sea buckthorn, aronia, grapes, rosehip, hawthorn.

It has been demonstrated that the lowest inhibitory and bactericidal concentration on *S. aureus* is found in white sea buckthorn powders, followed by rosehip groats and grape marc. In the case of *E. coli* and *K. pneumoniae*, only white sea buckthorn powder showed minimal inhibitory and bactericidal concentrations. According to the obtained data, we noticed that sea buckthorn has the most pronounced effect on tested bacteria. It was determined MIC and the lowest concentration was for sea bucthorn.

In conclusion we can say that using plant powders as food preservatives would be a solution to prevent foodborne illness and possibly resolve the problem of antibiotic resistance in the future and optimization of long-term food storage.

Keywords: antibacterial effect, diffusimetric method, plant extract, *in vitro*

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BIOTECHNOLOGICAL STRATEGIES FOR INNOVATION IN BIOECONOMY SESSION

MOLECULAR ENGINEERING OF GLYCOSIDE HYDROLASES WITH APPLICATIONS IN THE FOOD INDUSTRY

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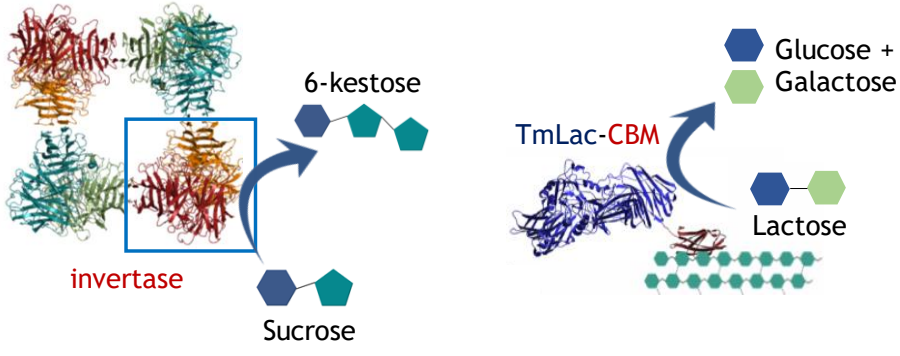
Glycoside hydrolases are enzymes with prominent applications in the food industry. Some relevant examples are the synthesis of prebiotic oligosaccharides, and the generation of lactose-free milk-products. Prebiotics such as fructo-oligosaccharides (FOS) are compounds of increasing commercial demand to be used in functional food, due to their health-beneficial properties. They are produced by hydrolysis of inulin but FOS with a broader chemical composition can be obtained by the residual transfructosylation activity of β-fructosidases using sucrose as substrate. We have used rational design, based on sequence alignment and structural analysis, to generate mutant versions of the *SUC2* gene from *Saccharomyces cerevisiae* encoding invertase. This study has contributed to define the structural determinants of transfructosylation efficiency and specificity. Moreover, some of these enzymatic variants showed significantly increased FOS synthesis yields, which were especially high for 6-kestose. On the other hand, the high prevalence of lactose intolerant phenotype among world population has raised the interest in lactose-free milk products, which are obtained by enzymatic hydrolysis with lactases (β-galactosidases). The implementation of enzymatic treatments in industrial processes can be significantly improved by using thermoresistant enzymes, which reduces the risk of contamination with mesophilic microorganisms and decreases protein purification costs.



Enzyme immobilization on solid supports provides additional advantages, since it facilitates enzyme recovery and recycling. In this regard, we have constructed

chimeric, thermoresistant versions of *Thermotoga maritima* β-galactosidase (TmLac) fused to carbohydrate binding domains (belonging to CBM2 and CBM9 families) which were specifically, compared to the wild-type versions, immobilized on different polysaccharides (chitin and cellulose). We have also studied binding efficiency on cellulosic matrices from different sources. Enzyme immobilization of chimeric proteins was stable during serial batches of hydrolysis of 5 % (w/v) lactose.

Keywords: prebiotic oligosaccharides, lactose intolerance, β-fructosidase, β-galactosidase, FOS

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ECO–CIGARETTES WITH SEEDS FLOWERS INCORPORATED INTO THE FILTER

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,,Man is the biggest polluter even though he is biodegradable.″ (Valeriu Butulescu)

Background and Aims.Cigarettes, we can say a lots of things about them. They became a hobby, are used in every moment, without thinking that they can make so much harm to the human body and the environment. In all cases the cigarettes filters are thrown away everywhere. I will not talk about how cigarettes or filters are made. I will talk about some few changes we can make to their filters to be useful or less polluting for the environment.

Methods and Results.The novelty proposed by me in this paperwork is to introduce in the filter, flower seeds like stone flowers, petunias, poppy flowers, lavender, Japanese trees and so on. These seeds must be very small so as not to change the size and structure of the filter. I also made a research about the position where these flower seeds can be placed into the filter. This study I made shows that I can place very easy some seeds on the paper covering the filter itself. The filter acts like a sponge when is thrown on the ground, absorbs the moisture and the seeds sprout and a plant will grow. This way the environment will be less affected and polluted.

Conclusions and significance of the study.The new type of cigarettes can be considered eco-cigarettes because their filters became friendly with the environment. Following the researches, the seeds of the plants can be positioned in the first part of the cigarettes filter because in this area where the filter is inserted into the mouth the smoke inhaled has low temperature and can' t affect too much the seeds quality.

The new type of eco-cigarettes can be considered a new future product. These seeds placed into the filters of the cigarettes greatly reduce their uselessness by the fact that after throwing them, they can transform themselves in a way pleasing to eye by the appearance of beautiful flowers or trees. I should want this solution can be applied but the researches keep going in this field.

Keywords: waste, pollution, butt, cigarettes, seeds

COENZYME Q_{10}: HEALTH BENEFITS AND BIOAVAILABILITY

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Introduction: Coenzyme Q_{10}, is a lipophilic metabolite present in nearly all human tissues, being involved in the electron transport chain in the plasma membranes of prokaryotes and in the inner mitochondrial membranes of eukaryotes. This coenzyme participates in aerobic cellular respiration, which generates energy in the form of ATP (95% of the energy of the human body is generated in this way). Therefore, the organs with the highest energy requirements (heart, liver and kidneys) have the highest concentration of CoQ_{10}. After the age of 30-35, the organism loses the ability to synthesise CoQ_{10} from food and levels of coenzymes deplete in the skin resulting in a reduced production rate of collagen and elastin formation.

Aims: This review focused on the health benefits of CoQ_{10} dietary supplementation and its bioavailability for human body.

Materials and Methods: In order to achieve the set goal, a screening of the scientific literature from the last 20 years dealing with this theme, was conducted. The literature screening was performed using: National Centre for Biotechnology Information (PubMed), Science Direct, Web of Science, Nature and Elsevier databases.

Results: Stress, infections, poor eating habits and ageing are only a few disorders which affect the organism`s ability to provide adequate amounts of CoQ_{10}. More than 200 clinical trials have investigated its use as a drug or dietary supplement and reported beneficial effects for human health.

Conclusion: Researches suggest that using CoQ_{10} supplements alone or in combination with other nutritional supplements may help to maintain the health of elderly people or treat some of the health conditions and diseases.

Keywords: Coenzyme Q_{10}, dietary supplementation, health benefits, bioavailability

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STUDY ON THE NEWLY LACTIC ACID BACTERIA STRAINS FOR THEIR PROBIOTIC BEHAVIOUR

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Lactic acid fermentation plays a crucial role in the development of healthy and nutritious food and feed with enhanced functional attributes. Some lactic acid bacteria strains are defined as probiotics that possess health-promoting effects when the administration of the living microbial cells is carried out constantly and in sufficient amounts. Therefore, the identification of novel probiotic strains is a long-lasting process involving various resources. The probiotics selection protocols must be carried out considering some key-features (resistance to low pH values, gastrointestinal stress conditions, antibiotics and antimicrobial spectrum). The aim of this work was to perform a preliminary selection of some lactic acid bacteria strains among a commercial starter culture used as control and other 3 strains of *Lactobacillus* spp. that were included into the Collection of Microorganisms of the Bioaliment Research Platform (coded MIUG). The above-mentioned strains were subjected to pH 2.0 and 3.0 or 0.3% bile salts resistance during 4 hours of incubation in aerobiosis at 37°C, on one hand. On the other hand, the lactic acid bacteria strains' survival after the gastrointestinal stress conditions using electrolytes solutions supplemented with 3 mg/mL pepsin or 1 mg/ mL pancreatin was also evaluated. The results suggested that the survival rates were greater than 80% after 4 hours of incubation at 37°C in aerobiosis in MRS medium at pH 2.0 for the strains MIUG BL 21 and MIUG BL 38. The strain MIUG BL 38 had a survival rate of 99.50% at pH 3.0 whereas only 92.99% of the cells from the commercial starter survived. Furthermore, the lactobacilli from the strains coded MIUG BL 21 and MIUG BL 24 were resistant at a concentration of 0.3% bovine bile salts, more than 90% of the cells survived. Finally, almost a quarter (24%) of the initial cells remained viable after the complete digestion protocol, this result being attired for the most resistant strain among the studied isolates, respectively *Lactobacillus* spp. MIUG BL 21. All these experimental data are a promising starting point for the complete characterization of the probiotic character for the studied strains that will contribute to the development of the novel concept of metabiotics in foods and ingredients production.

Keywords: lactic acid bacteria, lactobacilli, selection, probiotics, metabiotics

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EVOLUTION OF RHEOLOGICAL PROPERTIES AND FALLING NUMBER OF WHEAT STORED OVER A LONGER PERIOD OF TIME

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The quality of the rheological properties of wheat are essential for flour processing in the bakery industry. The problem of sprouting from a batch of stored wheat can lead to a sufficiently high enzymatic activity that compromises the functionality of the flour and the quality of the bread. The phenomenon is usually analyzed using the Hagberg Falling Number method. Maintaining the quality of cereals and preventing large product losses is achieved with the help of efficient storage systems. This paper evaluates the link between the effects of long-term, more accurate wheat storage and alveographic properties, along with Falling Number. The wheat from which the flour is obtained is stored for a period of at least 3 years, the purpose of this study being to observe the quality of the wheat over time. To obtain a high quality of the dough, the wheat must be conditioned 24 hours before being analyzed. In this respect 12 samples of common wheat were analyzed, from the area of the Curtea de Argeș, Romania. These are coming from the deposits of the National Administration of State Reserves and Special Issues. From the values obtained at Falling Number and Alveograph, the samples analyzed after several years of storage lost the quality they had when they were collected. Factors leading to deterioration of these properties could be improper storage, humidity, and temperature of the product as well as the microclimate not being controlled or monitored daily, ventilation is not provided by mechanical means, especially during the summertime, appropriate measures are not taken to keep these parameters within limits allowed, treatments against live pest infestation.

Keywords: wheat, Falling Number, alveographic properties, storage

INCREASING THE USAGE OF AGRO-FOOD BYPRODUCTS THROUGH *LACTOBACILLUS* SPP. FERMENTATION BY USING THE PLACKETT-BURMAN DESIGN

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This study evaluated the possibility of improvement of the bioactive content of some vegetal substrates (postbitication) by lactic acid fermentation with two selected lactic acid bacteria strains (*Lactobacillus* spp. MIUG BL13 and *Lactobacillus* spp. MIUG BL4) on a complex fermentation medium formulated based of some agro-food byproducts, such as okara, red lentil flour and sweet potato peel. The soybean residue - okara has a rich fibre composition, red lentils have a high protein profile and sweet potato residue is a source of simple carbohydrates and prebiotics, these being important compounds for the growth of bacteria and lactic acid fermentation.

The effect of seven factors (independent variables), such as the concentration of okara (1-5%), the concentration of red lentil flour (2-7%), concentration of sweet potato peel flour (2-6%), incubation temperature (25-37°C), incubation time (24-72h), inoculum size (0-4%) of MIUG BL13 and MIUG BL4 was studied by using the Placket-Burman design of the experiments and statistical analysis of the results by using the Minitab 17 Statistical Software (United Kingdom). Thus, by varying the range of the red lentil flour, the concentration of sweet potato peel flour, incubation temperature, incubation time, inoculum size, number of experimental samples were analysed. The total titratable acidity (TTA), antimicrobial activity and antioxidant activity were investigated as responses to establish the parameters with a positive impact on increase the bioactive metabolites content (postbiotics) in the fermented product.

Values for TTA between 3.75 - 16.87 mL NaOH 0.1N and for antioxidant activity between 0.94 - 2.4 mM TE/mL (DDPH method) were revealed. Additionally, values of 3.33 - 6.50 mm for antibacterial activity against *Bacillus subtilis* MIUG B1 strain were measured and the percentage growth inhibition of maximum 37.5% was calculated for antifungal activity, against *Aspergillus niger* MIUG M5 strain established.

The analysis based on the mathematical modelling and statistical analysis revealed that the most important biotechnological parameters with influence on the increase of the bioactive function of the fermented product are the concentration of okara, concentration of sweet potato peel and inoculum of *Lactobacillus* spp. MIUG BL13.

Further, the correlative influence of these selected variables on improving the postbiotics content will be analysed by Response Surface Methodology and an optimised variant of the fermentation conditions will be established.

The fermented product could represent a valuable bioingredient for food and feed formulation with increased in vitro and in vivo functionality.

Keywords: vegetal substrates, lactic acid fermentation, postbiotics, design of the experiments

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BIOTECHNOLOGICAL PARAMETERS WITH IMPACT ON BOVINE COLOSTRUM TRIBIOTICATION BY FERMENTATION WITH SELECTED LACTIC ACID BACTERIA

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The bovine colostrum is an excellent fermentation substrate for lactic acid bacteria because it contains many nutritional and bioactive compounds such as proteins, carbohydrates, fatty acids, amino acids, vitamins and minerals, respectively immunoglobulins, growth factors, hormones, enzymes, inhibitors, lactoferrin, cytokines, leucocytes, nucleosides and nucleotides.

The fermentation of the bovine colostrum with selected lactic acid bacteria aimed to increase the biological and nutritional benefits of the fermented product, in order to improve the tribiotic content, as well as the prebiotic, probiotic and postbiotic properties. In this context, the principal objective of this study was to identify the biotechnological parameters that influence the fermentation of the bovine colostrum with a co-culture of selected lactobacilli strains (*Lactobacillus* spp. MIUG BL13 and *Lactobacillus* spp. MIUG BL37) based on the results obtained after variables' screening by Plackett-Burman Design, mathematical modeling and statistical analysis. The colostrum concentration (5 - 10%, w/v), cells' density (1 - 2) established by the optical density at the wavelength of 600 nm, the agitation rate (0 - 150 rpm), the fermentation time (24 – 72 h), the volume of lactobacilli culture used as inoculum (MIUG BL13 and MIUG BL37) (1 - 2%, v/v) and the fermentation temperature (25 - 37^{o}C), were chosen as independent variables, their influence on the fermentation process being analyzed.

The responses were the titratable acidity (^{o}Th), antioxidant activity (DPPH method), the antibacterial activity (agar diffusion method) and antifungal activity (growth inhibition ratio). The fermented products obtained after the colostrum fermentation following the tested conditions, showed variability among the studied characteristics (i.e. titratable acidity values between 25 - 150^{o}Th and antioxidant potential between 0 - 0.37 mM TE/mL. The diameter of the inhibition zone between 2.17 - 5.50 mm against the *Bacillus subtilis* MIUG B1 was achieved and a growth inhibition ratio between 4.54 – 72.50% against *Aspergillus niger* MIUG M5 was calculated. Furthermore, the colostrum concentration, the fermentation time and the *Lactobacillus* spp. MIUG BL 37 inoculum, established as the most important parameters for bovine colostrum tribiotication, will be analyzed by Response Surface Methodology to identify/assess the optimal biotechnological conditions to increase the functional properties of the fermented product. The modification of the bovine

colostrum composition and its bioactive properties represent valuable ways in obtaining ingredients for food and feed fortification to enhance their functional features.

Keywords: bovine colostrum, lactic acid bacteria, tribiotics (prebiotic, probiotic, postbiotic), design of the experiments

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BATCH CULTIVATION OF *DESMODESMUS PSEUDOCOMMUNIS* IN A FLAT-PLATE PHOTOBIOREACTOR

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Microalgae are the first broth to attention when it comes to renewable energy. Their diversity accounts for the wide range of biofuels that can be derived from microalgae (i.e. biodiesel, biohydrogen, bioethanol, biogas etc.). With lower requirements than other feedstocks, the microalgae can reach much higher yields in terms of fuel potential, forming their own category, namely the third-generation biofuels. One of the most important characteristics of microalgae is their photosynthetic metabolism, which is the use of light as source of energy, dissolved CO_2 as inorganic source of carbon, and inorganic nutrients (i.e. nitrogen and phosphorus salts). Microalgae are cultivated in photobioreactors which are designed to provide a big lighted surface. They can be opened or closed, artificially or naturally lighted, according to the scope of the culture.

Even though microalgae have simple growth requirements, there are many obstacles to overcome to make this industry feasible. Reliable monitoring is required to develop the microalgae industry to reach high productivity of added value compounds.

In this study, a species of *Desmodesmus pseudocommunis* was cultivated in a flat-plate photobioreactor aiming to investigate the behavior of the culture in controlled conditions. The photobioreactor is provided with a series of sensors to monitor the pH, ORP, temperature, dissolved O_2 from photosynthesis and dissolved CO_2. The microalgae are cultivated in batch with constant incident light intensity and controlled pH. The pH is controlled by continuously bubbling gaseous CO_2 into the culture. Being an air-lift reactor, the mixing of the culture is made with N_2, which has a stripping effect over the CO_2 and O_2 formed through photosynthesis, thus making the gases dynamics very complex. The online acquired data are corelated with offline data, such as dry mass, chlorophyll, nitrogen, phosphorus, lipids concentration etc. and used to describe the observed behavior of microalge growth under photoautotrophic conditions.

Keywords: microalgae, photobioreactor, photosynthesis, chlorophyll, biodiesel

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REVIEW ON THE RELATIONSHIP BETWEEN pH - WHEY PROTEIN ISOLATE IN CURCUMIN MICROENCAPSULATION

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Micro- and nanoencapsulation of biologically active compounds from plant sources is an important concern of researchers today because they want to capitalize on them as efficiently as possible in various economic fields: pharmacy, cosmetics, medicine, agriculture, food industry, etc. Curcumin is a pigment that abounds in turmeric (*Curcuma longa*). There are studies showing reduced in vivo bioavailability, which, along with its high chemical instability and the possibility of its interaction with cytochrome P450s, and glutathione S-transferase, after absorption in the gastrointestinal tract, make curcumin a controversial molecule that requires further approaches.

The whey protein isolate (WPI) - curcumin particles concentration, the incorporated and the unincorporated curcumin percentage, all depend on the size of the WPI particles. The WPI particle 'size is influenced by the WPI molecules net electrical charge that closely related on pH. Therefore, the pH conditions play an indirect role in the encapsulation of a nutraceutical (curcumin) by using carrier biomolecules or biopolymers matrices.

When the WPI isoelectric point is close to the pH of the environment, the WPI molecules aggregation reach a maximum degree, the WPI particles' size reach a maximum value, given that the repulsive forces between the WPI molecules are greatly reduced. So, the binding affinity of the WPI particles for the curcumin molecules and microencapsulation efficiency reach maximum values. When the pH of the medium is different from the WPI pI, the repulsive forces that appear, prevent both their aggregation and the affinity for curcumin biomolecules, because the conformational changes make the binding sites more inaccessible. These studies improve knowledge about the micro/nano-encapsulation of curcumin and open new perspectives for obtaining functional foods.

Keywords: curcumin, whey proteins isolate, pH, particles'size, curcumin microencapsulation

SCREENING OF SOME MEDICINAL AND FOOD PLANTS EXTRACTS IN THE CONTEXT OF ALZHEIMER DISEASE

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Alzheimer's disease (AD) is a neurodegenerative disorder and represents the most common type of dementia among elderly people. Thus far, oxidative stress, acetylcholine (ACh) low levels and also the deposits of β-amyloid have been considered to play an important role in AD pathogenesis. However, several clinically advanced AD drug candidates have recently failed to show efficacy over placebo. Therefore, therapies with combination of drugs or the development of multitarget anti-Alzheimer drugs has become a primary objective. Extracts from four species of food and medicinal plants (*Curcuma longa*, *Vinca minor*, *Ginkgo biloba* and *Ilex paraguariensis*) were screened for antioxidant, antimicrobial and anticoagulant activity in an in vitro test. Turmeric (*Curcuma longa*) and lesser periwinkle (*Vinca minor*) extracts were the most active. Additionally, the content of selected extracts in polyphenols and flavonoids was measured. A mixture of extracts is a promising source for developing new medicine rich in active compounds to take care of Alzheimer's disease.

Keywords: Alzheimer's disease, antioxidant, antimicrobial and anticoagulant activity

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MULTIDIMENSIONAL APPROACHES FOR AQUACULTURE AND AQUATIC RESOURCES SUSTAINABILITY SESSION

EFFECT OF TEMPERATURE AND TIME IN WATERLESS TRANSPORTATION ON QUALITY AND PHYSIOLOGICAL STRESS OF *PENAEUS VANNAMEI*

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Waterless transport is an alternative method to realize the larger volume and lower cost of live aquatic products, this paper aims to study the effects of transport temperature and time on the physiology and body quality. Shrimps were divided into three groups, group I (18 °C, with water), group II (5 ℃, without water), and group III (10 °C, without water). Muscle, grill and liver for assay were sampled at 18 h, 24 h, 30 h and 36 h. The results showed that the best dormant temperature of *Penaeus vannamei* was 10.0±0.2℃. Muscle indicators including water content, total protein and crude fat exhibited no significant changes in all samples, but the cooking loss rate increased significantly after 18h at 5℃ and 30h at 10℃ ($p<0.05$). Muscle glycogen and succinic dehydrogenase (SDH) decreased significantly with the extension transportation time ($p<0.05$), and did not recover to control levels even after the shrimp re-watered. The results indicate that lower temperature will lead to intense stress in the early stage of transportation, however, it can maintain the metabolism of shrimp at a lower level in the later stage. Low-temperature waterless transportation has little effect on flesh quality of shrimp, and the optimal transport conditions for maintaining high survival rates of *Penaeus vannamei* is 10℃ for 18h. These findings provide the theoretical evidence to understand the effects of transport temperature and time on live shrimp and apply waterless transport in actual situation.

Keywords: *Penaeus vannamei*, transportation temperature, transportation time, muscle quality

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THE ROLE OF EMERGING AND RE-EMERGING INFECTIOUS AQUATIC DISEASE IN SUSTAINABLE AQUACULTURE AND MARINE FISH

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Emerging disease epizootics frequently cause substantial, often explosive, losses among populations of fish and shrimp, resulting in large economic losses in commercial aquaculture and threats to value stocks of wild aquatic animals. Also, climate change as an important challenge to the marine environment is showing its face in the health of marine organisms. Recent news about mass mortality of different species of fishes, sea birds, mammals, and marine invertebrates in some instances has been related to viral and bacterial outbreaks. The gradual warming of sea surface temperature, ocean acidification, sea-level rise, melting sea ice, and other side effects of climate change can be a major cause for the increasing trend of mortality of marine organisms. So far, there is an apparent increase in many infectious marine fish and shellfish diseases, including some newly-circulating ones (VNN, KHV, EHNV, WSD, etc.). It is expected that forthcoming climatic changes could make the situation worse. Marine disease outbreaks can impact the world fisheries in quantity and quality as well as marine aquaculture. There is a need to make necessary predictions for safeguarding marine production of the world because there is a huge dependency of different countries on fisheries. Also, knowledge gaps still exist regarding causative agents and transmission dynamics, so we need improved diagnostic methods and management strategies for control and prevention. Increasing outbreaks in some taxa are expected with climate change based on changes in physiological state for the host species (stressed or immunocompromised) and/or microbes (increased growth and virulence). The vulnerability and responses of marine organisms to climate change are highly variable, and certain species including marine calcifies, cold-adapted species, and rare, endemic, threatened, and endangered species are particularly at risk from climate change. Meanwhile, some routine Land-based management methods such as quarantining, culling, and vaccinating are not successful in the ocean; therefore, forecasting conditions that lead to outbreaks and designing effective tools/approaches to influence these conditions may be the best way to manage fish marine emerging diseases in the world.

Keywords: emerging diseases climate change, aquaculture, fish marine.

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HEMATOLOGICAL AND BIOCHEMICAL PROFILE FOR HEALTHY JUVENILES OF *ACIPENSER GUELDENSTAEDTII, ACIPENSER RUTHENUS* AND THEIR HYBRID

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Sturgeons are important fish species because they have a high economic value for both caviar and meat production and, therefore, aquaculture shows a great interest for their production. For sturgeon aquaculture, which usually implies long production cycle, animal welfare is associated with quality of end products. Periodically, in sturgeon farms, welfare should be assed rapidly, non-invasively through a set of blood indicators against a reference set of values. The aim of this research is to evaluate and compare the hematological and biochemical parameters of cultured Russian sturgeon (*Acipenser gueldenstaedti*), sterlet sturgeon (*Acipenser ruthenus*) and hybrid of Russian sturgeon with sterlet sturgeon juvenile at six and ten months of rearing in a flow-through aquaculture system. The hematological profile was determined using the routine methodology of fish hematology while blood plasma chemistry was investigated with VetTest® Chemistry Analyser, using IDEXX VetTest kits. The hematological and biochemical parameters analyzed were: red blood cell count (RBCc, x 106 µL-1), hematocrit (PCV, %), hemoglobin concentrations (g dL-1), erythrocyte constants (mean corpuscular volume – MCV µm, mean corpuscular hemoglobin – MCH pg, mean corpuscular hemoglobin concentration – MCHC g dL-1), total protein (TP, g dL-1) and glucose concentration (GLU, mg dL-1). At six months of age the results of red blood cell count, hemoglobin and hematocrit were significantly higher ($p<0.05$) at *A.ruthenus* and MCV, MCH and glucose concentrations were significantly lower ($p<0.05$) compared to the other two species. MCHC and total proteins concentrations did not show significant differences ($p>0.05$) between the studied species. The results show a grate inter and intraspecific variability for various groups of parameters. Nevertheless, the hybrid has a hematological profile closed to that of Russian sturgeon.

Keywords: sturgeons, welfare, hematological profile

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DENSITY INFLUENCE ON SURVIVAL DURING THE COLD SEASON ON PIKEPERCH (*SANDER LUCIOPERCA - LINAEUS 1758)* IN INDUSTRIAL AQUACULTURE SYSTEMS

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The survival of the one summer old pikeperch *(Sander lucioperca - L. 1758)* during the cold season is reduced (50-75%), due to the temperature decrease.In this period, the fish metabolism decreases, the feeding is more and more rare so the fish consumes his reserves accumulated during the hot season fact that causes weakness and disease predisposition . The researches took place during the years 2018, 2019 and 2020, at the Research and Development Station for Nucet Fish Farming. Wintering was done in ponds, in two variants: variant V1 - where no food was administered and variant V2 - where live food was administered (species without economic importance). The experiments for each variant were performed in three variants of densities, as follows: D1 density was 200kg / basin (2000kg/ha), D2 density was 500kg / basin (5000kg/ha) and D3 with density of 700kg / basin (7000kg/ha). The best survival results were obtained in variant V2 in 2020 which had a D1 98.8% density and the best results for weight gain were recorded in V2 in 2018 who had a D2 density and a growth spurt increase of 137kg.

Keywords: pikeperch, density, wintering, survival

STUDY ON THE LIVE TRANSPORTATION OF FISH AND ITS EFFECT ON FLESH QUALITY

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With the development of cold chain logistics technology for aquatic products, as an important part of it, the focus of preservation transport is not only on survival rate and physiological and biochemical indicators, but also on the impact of its transport process on the nutrition and quality of aquatic animals. This paper summarizes the methods of water- and waterless preservation transport of different fish, analyzes the mechanism of the preservation process on fish quality including protein, fat, glycogen and pH, and outline the changes of the main physiological and biochemical indicators in fish after preservation transport. Results show that the energy indexes and blood biochemical indexes of fish will change during live transport, and most of the indexes can be recovered to normal level after the recovery of fish at the end of transport, and the degree of recovery depends on the fish species, transport method, transport temperature and transport duration. A long period of inappropriate temperature preservation transport is very likely to cause irreversible damage to the kidney and liver of the fish, which will lead to a short survival time after recovery. Finally, by establishing a model of the influence of the parameters on the quality of fish preservation transport, and discussing the dependence of the key transport parameters on the quality indicators, the implementation process of preservation transport control is optimized. This paper presents an overview and summary of research related to quality control of fish preservation and transportation, and provides an important reference base and guidance scheme for improving fish preservation and transportation technology.

Keywords: fish, live transportation, effect, quality

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EFFECT OF KRILL OIL SUPPLEMENTATION ON LIPID AND GLUCOSE METABOLISM IN *CYPRINUS CARPIO* FINGERLINGS REARED IN A RECIRCULATING AQUACULTURE SYSTEM

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Fish feed formulation usually includes important quantities of fish meal from wild-captured fish. The continuous decline in ocean fish stocks has led to an accelerated rise in fishmeal price, leading the aquaculture industry, in order to save the use of fish proteins, towards consideration of carbohydrates or lipids as main energy source in fish feeds. A diet rich in carbohydrates or fats could lead however to lipid metabolism disorders, decreased antioxidant capacity and even reduced nonspecific immunity of fish. All these side effects are associated, on the long run, with lower resistance to diseases and poor technological performance. Based on krill oil and astaxanthin properties we hypostatized that supplementing them in fish feed will alleviate the above-mentioned effects and will improve growth of carp juveniles. The objective of the study was to evaluate the effects of krill oil (KO) supplemented in fish feed (5g/kg feed) on lipid and glucose metabolism of fish held in high stocking density in a recirculating aquaculture system (RAS). Therefore, the fish were divided into four groups: LD-NF (low density with normal feed), LD-KOF (low density with krill oil supplementation feed), and HD-NF (high density with normal feed), HD-KOF (high density with krill oil supplementation feed). Sampling and weighing of fish were carried in the beginning and in the end of the 5-week experiment. The blood plasma chemistry was investigated with VetTest® Chemistry Analyser, using IDEXX VetTest kits. The investigated parameters were represented by Glucose (GLU), Triglyceride (TG), Aspartate aminotransferase (AST), Alanine aminotransferase (ALT), Alkaline phosphatase (ALP), Cholesterol (CHOL) and cholesterol fractions (LDL and HDL cholesterol). The results showed that supplementation with krill oil inhibited the elevation of liver TG level from 17% to 22% compared with controls. Significant decrease ($p<0.05$) of ALP was observed in all fish groups receiving KO diet; however, in both groups fed with KO feed, serum glucose concentration increased compared with control groups.

Keywords: recirculating aquaculture systems, lipid metabolism, krill oil

Acknowledgement: The equipments used in this study belong to the infrastructure of UDJ Research Center MoRAS (www. moras.ugal.ro).

INFLUENCE OF DIET SUPPLEMENTED WITH TWO HERBAL OIL EXTRACT ON SERUM BIOCHEMICAL AND IMMUNOLOGICAL PARAMETERS IN STURGEON HIBRID

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In Romania the growth of sturgeons, including hybrids, in a controlled system started 20 years ago, to produce meat and caviar but also to reduce of pressure on natural wild sturgeon population. The important objective in aquaculture is to keep on fish health as well as to enhance fish performance. The aim of this study was to evaluate the effects of sea-buckthorn and thyme oil extract on the biochemical parameters and immunity responses in sturgeon hybrid to improve their physiological status. Fish were randomly distributed in four treatment groups including V1-CNT–Control, untreated fish, fed with normal diet, V2-SB- fish fed with 1% Sea buckthorn/kg feed, V3-TH- fish fed with 1% Thyme/kg feed and SB+TH- fish fed with 0.5% Sea buckthorn and 0.5% Thyme/kg feed. Six fish per group were used for blood sampling, for the determination of immunological (lysozyme, MDA, TAC) and biochemical (ALB, ALT, AST, CHOL, GLU, TP, TRIG, GLOB) parameters. Supplementation of the diet with oil extract from thyme and sea buckthorn led to changes in the blood metabolic profile of sturgeon hybrids, but, of different intensities, depending on the specific action of each type of extract. Statistical analysis of biochemical parameters indicated that were no changes in triglycerides, alanine aminotransferase and aspartate aminotransferase of all treatment groups compared to the control. There were significant changes in the glucose, total protein and albumin of fish from V2 and V4 group. The immunostimulant role of herbal extract is evidenced by the increase of the TAC and lysozyme. The obtained results underline the role of this plant extracts in maintaining an optimum physiological state of sturgeon hybrid health.

Keywords: herbal immunostimulant, sea buckthorn, thyme, biochemical parameters, sturgeon

Acknowledgement: The equipments used in this study belong to the infrastructure of UDJ Research Center MoRAS (www. moras.ugal.ro).

PRELIMINARY RESEARCH ON THE DISTRIBUTION OF THE OTTER POPULATION ON THE DANUBE RIVER (GRINDU - TULCEA)

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The eurasian otter (*Lutra lutra*) is a semi-aquatic mammal species strictly protected under national and international law. It is a species of carnivore that is at the top of the food chain and is considered an important bioindicator of the well-being of aquatic ecosystems both in terms of water quality and riparian habitat. In Romania, the otter is widespread throughout the country, especially in lakes and valleys of large waters, which have rich food resources (fish, shellfish and amphibians) but especially in ponds and the Danube Delta (Brehm, 1964). The present paper aims to present a case study, conducted between March and November 2020 in the floodplain (dam – shore) of the Danube River, between Grindu (Cotu Pisicii) and Tulcea. This case study presents the distribution and the abundance of the eurasian otter as well as a dynamic of signs of presence during the study period. Because the activity of otters is mainly twilight and nocturnal, the results were obtained by the method of inventorying the signs of presence specific to these species: otter spraint (faeces), tracks (footprints), anal gellies. Their abundance indicates an intense activity of this species on the studied river sector. Depending on the abundance of presence signs, we consider that there are three agglomerations of them along the Danube bank, two of them being similar in terms of riparian habitat type and one different. Also, the analysis of the dynamics of the presence signs shows that from the point of view of the seasonal dynamics, their greatest abundance was met in summer and from the point of view of the degree of freshness, in autumn.

Keywords: eurasian otter, aquatic ecosystem, spraint.

GROWTH AND DEVELOPMENT OF KALE (*BRASSICA OLERACEA* L. VAR. *SEBELLICA*) AND ARUGULA (*ERUCA SATIVA*) IN AN AQUAPONIC SYSTEMS

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Aquaponic is an innovative technology which combines hydroponic plant production into recirculating aquaculture systems (RAS) and can be an alternative to produce food closer to urban centers. Although in the last years aquaponics has a continued trend of development there are still limited studies regarding the performance of the different aquaponic plants in such growing systems. In this context, this experiment aimed to compare two different fish (*Cyprinus carpio*) stocking densities and study the effects on the growth and development of kale (*Brassica oleracea* L. var. *sebellica*) and arugula (*Eruca sativa*). The experiment took place at the pilot aquaponic system from University Dunărea de Jos, Galați, Faculty of Food Science and Engineering. The aquaponic system consists of four rearing units for fish, eight aquaponics units filled with substrate light expanded clay aggregate (L.E.C.A.), led lamps for plants with purple light (36 W), biological and mechanical filters, and pumps for water recirculation. The experiment used a design with two stocking densities of fish, in duplicate: D1: V1-16.89 kg/m^3 and V2 - 17.62 kg/m^3, respectively D2- V3-21.32 kg/m^3, and V4-21.53 kg/m^3. In each aquaponic unit were planted fifteen kale and arugula seedlings (Figure 1). The physico-chemical parameters of water were measured twice per week during the trial. At the end of the trial, the fresh weight of the plants was measured, and it was concluded that the productivity of the plants was highly dependent on the fish stocking density with higher biomass at the higher densities of fish.

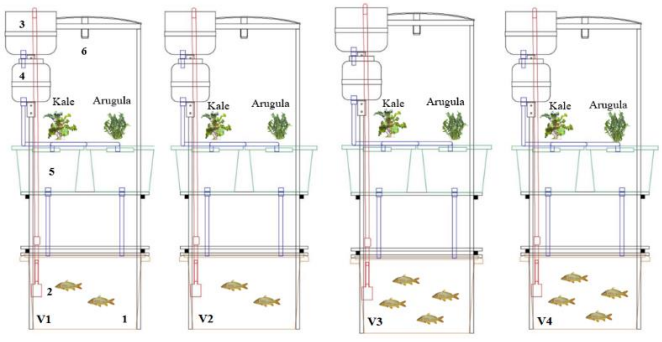

Figure 1. The scheme of the aquaponic system

1- fish rearing unit; 2- recirculation pump; 3- mechanical filter; 4- biological filter; 5- aquaponic units; 6- led lamp)

Keywords: aquaponic, kale, arugula, fish density, fish growth.

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EFFECT OF DIETARY ADMINISTRATION OF SEA-BUCKTHORN (*HIPPOPHAE RHAMNOIDES*) AND THYME OIL (*THYMUS VULGARIS*) ON GROWTH PERFORMANCE AND BIOCHEMICAL COMPOSITION OF HYBRID STURGEON *A. RUTHENUS* ♀× *A. GULDENSTAEDI* ♂

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This study evaluated the effects of dietary administration of sea-buckthorn and thyme oil on growth performance, feed utilization, and biochemical composition of meat of sturgeon hybrid *A. ruthenus* ♀× *A. guldenstaedi* ♂. Fish with an initial weight of 301.73±74.50 g were randomly distributed in four experimental variants: V_1- control group, were fish were fed with pelleted containing 54% crude protein and 15% fat, V_2- pelleted feed supplemented with 1% sea-buckthorn/kg diet, V_3- pelleted feed supplemented with 1 % thyme/kg diet, and V_4- pelleted feed supplemented with 0.5 % sea-buckthorn/ kg diet and 0.5 % thyme/kg diet. The experiment lasted for 10 weeks. At the end of the trial, fish from V_4 had significantly increased ($p<0.05$) growth parameters (final weight, weight gain, specific growth rate and feed conversion rate) compared to the V_0 variant. The survival was 100% in all the experimental variants. Regarding the biochemical composition of fish at the end of the experiment, significant differences ($p<0.05$) were recorded between the experimental variants, regarding the moisture, protein content, ash, fat content, and gross energy. Proximate analysis revealed the increase of protein, ash content, and gross energy, respectively the decrease of water and lipids content in the experimental variants V4. Overall, the biochemical analyses of fish meat indicate that dietary administration of these plants improves the biochemical composition of fish in comparison with V_0. The results of current study showed a positive effect on the growth performance and meat quality of hybrid sturgeon. At the same time, the information obtained can be useful for fish nutrition in order to provide healthy and economical feed for sturgeons.

Keywords: aquaculture, hybrid, sturgeon, fish growth, body composition.

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THE EFFECT OF IMAZALIL ON BIOCHEMICAL PARAMETERS OF BLOOD IN STERLET JUVENILES

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The latest data on the analysis of the water quality of the Danube provide worrying information about the emergence of certain pesticides. Among them, imazalil indicates an emerging state among various contaminants in Danube's water contributing to the aquatic habitats' pollution. Due to their migratory life, sturgeons are mostly sensitive to these habitat alterations that can impact on organism's physiology affecting their health and spawning success. Our study presents the results of the effect of imazlil on the biochemical parameters of blood sterlet sturgeon (*Acipenser ruthenus*) juveniles as part of more complex physiologically investigations on the ecotoxicological response of sturgeons to this aquatic contaminant. After 21 days of imazalil dietary exposure, serum samples from each experimental variant were analyzed using commercial kits for blood chemistry autoanalyzer (VETTEST 8008) for: albumin (g/dL), alanine aminotransferase (U/L), aspartate aminotransferase, glucose (mg/dL), lactate dehydrogenase (U/L), total bilirubin (mg/dL), total protein (g/dL). Dietary exposure of young sterlets to imazalil at the environmental concentrations induced a complex pattern of biochemical alterations in the sterlet juveniles' blood, especially for serum enzyme activities, showing the suitability of using these parameters for assessing the physiological status of the fish to pollutant.

Keywords: *Acipenser ruthenus*, juveniles, imazalil, blood biochemical parameters

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CONTROL AND PREVENTION OF DISEASE AS A CRITICAL APPROACH IN SUSTAINABILITY OF AQUACULTURE PRODUCTION

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In recent decades, the demand for aquatic animals as an animal protein source has been increased. Due to the limited wild fisheries stocks, the aquaculture sector has been rapidly expanding in food-production industries. Diseases have been considered as one of the main constraints on the development of the global aquaculture industries. Owing to the increasing of intensive aquaculture, introducing new species and transboundary movement of aquatic animals, new diseases have recently emerged which has led to severe economic losses in the industry. Therefore, aquatic animal health management is necessary to sustain aquaculture growth. In this paper, we discuss the role of control and prevention approaches of diseases in aquaculture sustainability. The control and preventive measures including rapid diagnosis of infections, vaccination, disinfection of water, use of free-pathogen stocks, and use of probiotics and immunostimulants would be effective in preventing the spread of pathogens. Among the control measures, vaccination and rapid detection of diseases have made significant contributions to the outbreaks. During disease outbreaks, early detection and fast actions, such as timely quarantines, are one of the most effective control strategies have an important impact on the outbreak of infections. Currently, different rapid and point-of-care diagnostic methods such as Loop-Mediated Isothermal Amplification (LAMP), lateral flow immunochromatographic test strip (LFIT), crisper-based test, and biosensors have been developed. These preventive approaches lead to reduce the consumption of antibiotics or chemicals, and thus the threat of antimicrobial resistance and residues in aquatic products. In conclusion, a combination of various preventive approaches would result in aquatic animal health protection.

Keywords: aquaculture, diseases, health, control, rapid detection

THE USE OF *PECTINATELLA MAGNIFICA* AS BIOINDICATOR FOR HEAVY METAL POLLUTION IN A LENTIC ECOSYSTEM

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Water pollution with heavy metals is a persistent and hazardous issue, due to the metal's incapacity to decompose and its tendency to accumulate in biota. The lentic aquatic environments of Danube Delta are subjected to anthropogenic pressures, due to intensive agriculture, intense tourism, and the lack of sewage systems. The influence of global warming, through increase water temperature, has allowed alien species development in the waters of Danube Delta, such as *Pectinatella magnifica*. Therefore, the aim of the present study was to use the bryozoan as bioindicator for heavy metal pollution in Barcaz Lake, Danube Delta. Water and biota samples were collected in previously decontaminated flasks and PE bags, in September 2020, from Barcaz Lake and transported to the laboratory. The quantification of Cd, Pb, Ni, Cr, Cu, Fe and Zn in samples was determined by using the technique HR-CS-GF-AAS and Analytik Jena Contraa 700 equipment. Also, the pollution index for each metal was calculated. Pearson coefficient was applied for the correlation analysis of water and biota results. The maximum registered values for the analyzed metals in the water matrix were as it follows: 5.87 µg/L Cd, 0.91 µg/L Pb, 4.07 µg/L Ni, 0.32 µg/L Cr, 3.98 µg/L Cu, 0.12 mg/L Fe, 0.06 mg/L Zn. All studied metals did not exceed the maximum permitted level by the national regulation of surface waters, except for Cd, which exceeded the value of 5 µg/L and it is specific to quality class V waters. The following average accumulation trend was identified in the water matrix: Fe>Zn>Cu>Ni>Cd>Pb>Cr.

Keywords: Danube Delta, bryozoan, heavy metals

THE PHYSIOLOGICAL RESPONSE OF FISH TO AQUATIC HYPOXIA

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Hypoxia is a decrease in dissolved oxygen that causes physiological disturbances in marine fishes and invertebrates, including reduced mobility, growth rate and reproductive success, altered phenology and increased vulnerability to diseases. Hypoxia in aquatic ecosystems, freshwater or marine, can be a natural phenomenon, such as nocturnal hypoxia in lakes or the minimal oxygen layer in the oceans, but it is often the result of anthropogenic activities. One of the most harmful influences in recent years is that of anthropogenic eutrophication from agriculture or urbanization, as well as from global warming. The present study reveals aspects related to sublethal impact of hypoxia on fish. Thus, it is revealed that oxygen deficiency in relation to metabolic demand can cause hypoxic stress, a decisive role being played by water temperature, which influences both oxygen solubility and metabolic demand of aquatic organisms. Since fish are exposed to considerable variation of water dissolved oxygen concentration, they have evolved a series of responses to maintain life during hypoxia and anoxia. These responses are at the behavioral, physiological and molecular levels. Fish respond to hypoxia by attempting to maintain oxygen delivery, down regulating aerobic processes and up-regulating anaerobic metabolism. Hypoxia limits the transport of dissolved oxygen through the gill membrane and the amount of cellular metabolic activity, which in turn inhibits the vital activities of the entire body of fish. Hypoxia inhibits growth in a variety of fish species, primarily via a reduction in food intake. It can be concluded that while the appetite-suppressing effects of hypoxia are well recognized, the mechanisms mediating this response are not known. In the presence of a limited oxygen transport system, these fishes may only maintain aerobic metabolism during aquatic hypoxia by increasing their air-breathing frequency and, hence, rate of aerial (vs. aquatic) respiration. Therefore, future research should focus on understanding the physiological mechanisms underlying the observed differences in hypoxia tolerance.

Keywords: hypoxia, fish, response, physiological

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IMPORTANCE OF VIRAL DISEASES IN SUSTANABLE AQUACULTURE

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The fast growing global demand for seafood and the limited capacity of fisheries sector lead to the expanding of aquaculture practices which rapidly to become a major global industry around the world. Aquaculture is now integrated to the economies of many countries. Because of dense farming, aquatic animals experience a different environmental situation and environmental stress in the intensive systems including fresh and brackish water and marine systems that provides the necessary conditions for the emergence of new diseases. Viral diseases are important because a few treatments are existing and the effective viral vaccines for using in aquaculture have not yet been completely developed. The viruses usually occur in the species that live at lower temperatures and they are temperature dependent. Also, viruses are host-dependent and infect certain species or groups. Therefore, specific control and prevention strategies should be adopted based on the host species and the type of virus. Also, the principles of biosecurity must be employed. Prevention strategies are depending on the viral properties such as viral pathogenicity, host susceptibility to the viruses and the environmental factors and the presence of reservoir hosts. Most of these parameters are not known for aquatic viruses, which effect the optimal control strategies. Most of the viral infections, causes high mortality in fingerlings but adults become carrier. So Specific Pathogen Free (SPF) aquatics are highly recommended for stocking the farms in sustainable aquaculture. This review introduces the major viral pathogens of farmed fishes and discusses the health management strategies to control and prevent of the major pathogens. It also considers the potential for future disease emergence in aquatic animals to expand and faces the challenges presented by climate change.

Keywords: sustainable aquaculture, viral diseases, control, SPF, fish

BIOCHEMICAL COMPOSITION OF SEVERAL COMMERCIALLY FISH SPECIES FROM THE DANUBE RIVER

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In recent decades, the population fish consumption increased with the increasing of the preference for healthier foods. Fish is an important source of nutrients, beneficial for human health. Fish is one of the most important dietary sources of fat-soluble vitamins and polyunsaturated fatty acids (PUFA). Generally, their proximate composition depends on the fish species, feed, gender, maturation and environmental factors. In this context, this study aimed to determine the proximate composition of some fish species from the Danube River. The fishing area was situated between km 169 (Brăila) and km 197 (Gropeni). Fish were captured during the year 2020. The analyzed fish species were: Pontic shad (*Alosa immaculata)*, common carp (*Cyprinus carpio)*, white bream (*Blicca bjoerkna)*, barbel *(Barbus barbus)*, asp *(Aspius aspius)*, bream *(Abramis brama)*, ide *(Leuciscus idus)*, european perch *(Perca fluviatilis)*. All samples were analyzed for moisture, protein, fat, ash and gross energy. The highest content of lipids was obtained for Pontic shad, while the lowest was obtained for asp, ide and european pearch. Regarding the protein content the highest values was obtained for Pontic shad and carp. As a main conclusion of this study was that all the species have a higher nutritional value.

Keywords: proximate composition, protein, lipids, ash, gross energy.

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PHYSIOLOGICAL RESPONSE OF MARINE ORGANISMS TO POLYCYCLIC AROMATIC HYDROCARBONS ACTION

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Marine environments are subjected to different types of pollutants that enter the water bodies through several routes such as industrial, domestic and agricultural waste waters, release and discharge of petroleum and its chemical. They are increasing worldwide affecting seawater ecosystems due to the long-lasting effects of these pollutants. The continuous development of oil exploration and exploitation is accompanied with the negative impact on marine ecosystems, resulting in extreme consequences for the marine environment, characterizing the physical, chemical and biological damage of the water, sediments and impacted natural resources. The risk of oil contamination leads to the need to highlight the early effects of hydrocarbons, especially polycyclic aromatic hydrocarbons on marine organisms. Polycyclic aromatic hydrocarbons are petroleum components that, when dissolved in the aquatic environment, can disrupt normal animal physiological functions and negatively affect species populations. In this regard, worldwide biomonitoring programs assess the effects of polycyclic aromatic hydrocarbons. Biomonitoring or biological monitoring can be defined as the systematic use of biological responses to assess changes in the environment. Since fish inevitably affected by coastal and marine pollution, research on its physiological response is being proposed as a complementary diagnostic tool to evaluate the ecosystem quality and health status. The physiological response of marine organisms is investigated both at functionally (reproductive, respiratory, cardiovascular and neurological disorders) and tissue, cellular and molecular levels (histopathological evaluation, DNA damage, acetylcholinesterase (AChE), cytochrome P4501A mRNA or protein, ethoxyresorphin - Hepatic deethylase (EROD)). This paper examines the pros and cons of using changes induced by polycyclic aromatic hydrocarbons in marine organisms to assess the health of aquatic ecosystems.

Keywords: biomonitoring, physiological response, polycyclic aromatic hydrocarbons, marine organisms, sea water

COMPARATIVE STUDY REGARDING TO THE MORPHOLOGICAL CHARACTERIZATION OF BLOOD CELLS AT DIFFERENT FISH SPECIES

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The aim of this research was to characterize the morphological aspects of fish red blood cells and lymphocytes. The biological materials used in this study were: common carp (*Cyprinus carpio*) from a recirculating aquaculture system, tench (*Tinca tinca*) from a recirculating aquaculture system and pontic shad (*Alosa immaculata*) from the natural environment (harvested for scientific purposes, at the beginning of migration from the sea to the Danube to reproduce). For the analyze of morphological status of fish red blood cells and lymphocytes was appealed to the blood smears realization. The coloration was made with the help with May-Grundwald - Giemsa stains. Regarding to the size of red blood cells (RBCc) and small lymphocytes, their differences were found in the three fish species studied in *Cyprinus carpio, Tinca tinca,* respectively *Alosa immaculata*. It was observed that at *Tinca tinca* species the RBCc are the most elongated and at the same time fusiform compared to the RBCc from *Cyprinus carpio* in which they are elongated but more convex. Among the analyzed species, *Alosa immaculata* has the smallest RBCc (in length), which have an oval to spherical shape. At these species, the RBC nucleus had different shapes and sizes. The most elongated shape of the RBC nucleus was found in the species *Cyprinus carpio.* In the species *Tinca tinca* and *Alosa immaculata* the RBC nucleus is similar having an approximately spherical shape. In the case of small lymphocytes can be said that their largest size was found in carp and those with the smallest size were found in pontic shad. We can specify the fact that the lymphocytes from tench are much more spherical than in the other two species. In conclusion, the information presented in this paper represents a data basis because it plays a special role in the study of the welfare status of the fish.

Keywords: blood cells characterization, *Cyprinus carpio, Tinca tinca, Alosa immaculata*, recirculating aquaculture systems.

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THE TROPHIC SPECTRUM OF SOME GOBY SPECIES FROM THE ROMANIAN INFRALITTORAL OF THE BLACK SEA

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A very important aspect of the fish biology is represented by their way of alimentation. The richness of the trophic resources constitutes an essential factor for the size control and for the fish population distribution, leading to intricate biotic interactions like: competition, migration. The research was conducted during 2013-2014 and had as main objective the information on the trophic spectrum of 4 goby species (*Apollonia melanostomus*, *Neogobius cephalarges*, *Mesogobius batrachocephalus* and *Gobius niger*) from various areas of the Black Sea and pursues to establish the nourishment's quantities and the qualitative composition. The fish were measured with the identifier to determine the length classes and weights to determine the weight classes. To analyze the gastrointestinal content and to determine the ingested organisms, a binocular microscope was used. The filling index of the gastrointestinal tracts was estimated through the feeding coefficient calculation (CH). For the Apollonia melanostomus females the filling index of the digestive tract was 48% and for the male 52%. For the N. cephalarges females the digestive tract is 56% full comparable to 44% for the males. For the Mesogobius batrachocephalus females the filling index of the digestive tract was 44% and for the male 56%. For the Gobius niger females the filling index of the digestive tract was 33% and for the male 67%. The average filling index of the digestive tract is much higher among the males (103.97) compared to those of females (80.64). The main food is psamobionte mollusks which represents a high trophic importance. In conclusion, knowing the fish trophic spectrum may provide precious solutions for the lasting usage of the fishy resources.

Keywords: goby species, intestinal content, trophic spectrum, filling index, Black Sea.

COMPARISONS OF NITROGEN, PHOSPHORUS AND CALCIUM MASS BALANCE FOR DEEP WATER CULTURE AND SUBSTRATE-BASED AQUAPONIC SYSTEMS

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Aquaponics are characterized as sustainable fish-plants production systems, mostly due to high efficiency in terms of nutrients utilization. The nitrogen (N), phosphorus (P) and calcium (Ca) are considered highly important macro-nutrients within aquaponic systems, as they are essential for both fish and plants biomass growth during the entire production cycle period. Aquaponic systems are mostly based on 3 general design techniques, as follows: deep water culture (DWC), nutrient film technique (NFT) and substrate-based technique. In order to improve aquaponics sustainability, a synergy must be identified between aquaponic system design technique and fish and plants nutrient requirements. Thus, the present study targets to assess N-, P- and Ca-use efficiency (NUE, PUE, CaUE) in two aquaponic production systems, based on DWC and light expanded clay aggregate (LECA) substrate techniques, respectively. The data were collected during a 44 days full production cycle for tested plant biomass. The N, P and Ca mass balances were developed by using N, P and Ca concentrations in fish feed, solid waste, wastewater, technological water, fish and plants biomass. The results revealed higher percentage of N, P and Ca assimilated in both fish and plant biomass at substrate-based, compared to DWC aquaponic system. Also, all analyzed nutrients registered a higher loss percentage via solid wastes if substrate-based aquaponic technique is applied, compared to DWC technique. Therefore, the N, P and Ca mass balance analyses revealed that substrate-based technique is more efficient, compared to DWC. However, all analyzed macro-nutrients (N, P, Ca) recorded low assimilation percentage via plant biomass, in both tested aquaponic techniques. Therefore, it is recommended to increase plant culture density or to decrease fish feeding ratio, in order to improve NUE, PUE and CaUE. Future studies should consider the variation of hydraulic parameters (hydraulic retention time, hydraulic loading rate) and also, the use of different hydraulic regimes (continuous flow, ebb and flow) in order to identify a proper aquaponic production model, from both the perspectives of engineering design and production technology performance, which will further improve the efficiency of aquaponic systems.

Keywords: nitrogen, phosphorus, calcium, aquaponic, mass balance

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METHODS OF PREPARING SOME PRODUCTS BASED ON OF THE PLANT PRODUCT - *CHELIDONIUM MAJUS* L.

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Chelidonium majus L. is one of the wonders of nature, it is an indigenous plant unpretentious to environmental conditions. *Chelidonium majus* L. contains over 70 compounds and 24 macro- and microelements, of which: alkaloids, flavonoids, saponins, vitamins, minerals, aromatic and aliphatic acids, phytosterols, alcohols, etc. compounds that are recommended in the treatment of many diseases. Celandine has been widely used since antiquity as a plant with various effects on the body: antimicrobial, anti-inflammatory, antioxidant, hepatoprotective, antidiarrheal, antihypertensive, cardioprotective, antitumor, hypoglycemic, lipid-lowering and antiatherosclerotic. If, in the past, the use of the plant for curative purposes was based on popular tradition, nowadays, researchers have managed to isolate the active substances from rosehip, responsible for its therapeutic effects.

The vegetable product - celandine was harvested from the spontaneous flora from Gârboavele Forest, Tuluceşti Commune, Galaţi County. The aerial part of the plant was harvested in May (when flowering began). The aerial parts, the healthy ones were cut (leaves, stem, flowers) with a knife carefully so as not to uproot the plant (to give new stems), foreign bodies were removed. Drying was done naturally by placing the plant in a shady, airy, ventilated, free of moisture, in a thick layer of medium size and turned from side to side at an interval of 2 days carefully so that the leaves will not break. After the vegetable product - rose hips were dried (and acquired a dark green color), by various methods of preparation was obtained products based on horse rider, namely: celandine tincture, celandine oil, celandine ointment, celandine vinegar, celandine syrup, celandine wine.

Keywords: celandine, tincture, oil, ointment, vinegar, syrup, wine

A SHORT REVIEW OF THE COMMON CARP BIOLOGY AND REPRODUCTION TECHNOLOGIES

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The carp (*Cyprinus carpio*, Linnaeus 1758) is the main cyprinid crop, with the most considerable economic importance in the ponds in Europe. Originally from central Europe, the Black Sea basins, the Azov and Caspian seas, carp are very widespread: in Asia, from the Amur basin and Japan to Indochina and Europe. The origin of the domestication of the common carp, most probably, is confused with the beginnings of the aquaculture that took place 4,000 years ago in China (R. Billard, 1995). In Romania, the development of systematic fish farming began relatively late, respectively the 40-50 years, when actions take to extend the growth of the crop carp, emphasizing the need to research the development and promotion of the growth of the culture carp in ponds and ponds, the selection and his improvement. The action was started in the 1950s, and continued after 1960, in a more organized and precise manner. As a result of this activity, of the fish research, interwoven with the biological studies, some achievements have been obtained in the field of fish selection and hybridization, especially in the carp, to find new forms, resistant to the diseases and with a fast growth rate. This review summaries and evaluates brief knowledge about carp biology and reproduction technologies.

Keywords: *Cyprinus carpio*, reproduction, aquaculture, culture carp

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INFLUENCE OF DIFFERENT STOCKING DENSITY ON GROWTH PERFORMANCE AND BODY COMPOSITION OF JUVENILE EUROPEAN CATFISH (*SILURUS GLANIS*)

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The current study followed effects of different stocking density on growth performance and biochemical composition body of juvenile European catfish (*Silurus glanis*) reared in a recirculating aquaculture system. A total of 450 juveniles catfish fish (158.9±0.26 g body weight) were divided into four groups: V_1-14.28 kg m^{-3}, V2–28.59 kg m^{-3}, V3–42.97 kg $m^{-3}$and V4-57.06 kg m^{-3} After 32 experimental days, the biomass gain (BG), feed conversion ratio (FCR), specific growth rate (SGR), protein efficiency ratio (PER), morphometric relationship between length-weight (LWR), coefficient of variation (CV) was calculated. Also, the biochemical composition of fish meat was determined. At the end of the experiment, the specific growth rate (SGR) calculated was significantly better in the variant with smallest density: 1.19 % day^{-1} (V1) comparing with higher density variant V4 (0.79% day^{-1}); protein efficiency ratio PER (g/g) registered a better value at V1 (2.04 g/g) comparing to V4 (1.28 g/g). The biochemical analysis of meat from all four experimental variants shows not significant differences ($p>0.05$) regarding the protein content, while the higher amount of fats was quantified in the variant V1 (17.81±0.97 %) comparing to experimental variants with higher stocking densities The results from this study revealed that the biotechnological indicators showed a better growth of the catfish biomass maintained in lower stocking densities.

Keywords: *Silurus glanis*, stocking density, meat composition

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ECONOMIC EVALUATION OF A COMMERCIAL RECIRCULATING AQUACULTURE SYSTEM FOR CARP (*C. CARPIO* L. 1758) INTENSIVE REARING BY USING PROBIOTICS

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The economic efficiency of a recirculating aquaculture system (RAS) is often depending on the existence of an adequate market, in order to ensure the sale of fish which have reached the marketable size. An important advantage of rearing fish in RAS is the continuous and constant availability of the product for the market throughout the year. Under the conditions of obtaining a fish production of 35 tons of carp per each production cycle and assuming that the fish cost is set at the average price of 3.8 €/kg, an income of approximately 133,000 € is estimated to be generated. The analysis of economic indicators points out that the annual profit obtained is 10,670 € and the unitary cost of production is 3.49 €. The economic activity of carp rearing in RAS by using probiotics as fish feed bio-additives, has proved to be economical sustainable, both in the short term (during a production cycle) and in the long term (for 6 years).

Keywords: economic indicators, RAS, carp, probiotics.

THE STATUS OF THE COMMON CARP CAPTURES (*CYPRINUS CARPIO, LINNAEUS*, 1758) FROM DANUBE DELTA DURING THE YEARS 2014-2020

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Cyprinus carpio, Linneus 1758 is a semi-migratory species (enters the ponds in spring where it breeds and returns to the Danube in autumn) which is often found in catches from the Danube Delta. Common carp has major importance for commercial fishing, family, and recreational-sport fishing in the Danube Delta Biosphere Reserve (RBDD) area, but in the recent decades, due to eutrophication processes and overfishing, carp stocks have been decreased. Commercial carp fishing is practiced mainly in stagnant waters (lake complexes in RBDD) and less in the Danube river, with nets, talians, or whistling. Recreational carp fishing is more often practiced in the Danube River and large canals than stagnant waters. Regarding the evolution in time of the average annual commercial catches from RBDD they were 604.900 kg in the 1960`s, 303.700 kg in the 1970s, 111.400 kg in the 1980`s, 65.800 kg in the 1990s, 134.750 kg in the 2000`s, respectively 118.912 kg for the years 2014-2020. Following the analysis of the estimated values of unreported catches (IUU) of carp on the territory of RBDD it can be seen that: in 2014 IUU represented 40% of the value of reported commercial catches, in 2015 it was 35%, in 2016 it was of 33%, in 2018 it was 50%, in 2019 it was 42% and in 2020 it was 58%. The value of carp catches resulting from recreational-sport fishing is difficult to quantify, which makes it difficult to analyze the catch data. This paper analyzes the situation of carp catches in the Danube Delta, a common species with an important role both for natural fish habitats in the RBDD and for fishing.

Keywords: common carp, commercial captures, fishing, Danube Delta

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OPTICAL OBSERVATION AND HYPERSPECTRAL CHARACTERIZATION OF NANOSCALE AND MICROPLASTICS IN COMPLEX ENVIRONMENTAL MATRIXES

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The ever growing amount of plastics in the environment are naturally broken down into nano and micron scale sizes and are found in plant, soil and live organisms. To study these nano and micron scale plastics in controlled experiments, effective imaging tools are required to understand how the plastics interact with and affect these environmental matrixes. A novel darkfield hyperspectral microscope technology has been specifically developed to support label free imaging and spectral analysis of nano and micron scale materials in complex biological matrixes. This includes a wide range of polymers. This technology utilizes patented darkfield-based illumination optics, creating high signal-to-noise images of non-fluorescent nanomaterials interacting with both biological and materials samples. The integration of hyperspectral imaging with this high signal-to-noise microscopy technology allows the creation of high resolution spectral images. This enables the characterization of nano-materials based on their chemical composition and added functional groups. It also provides the ability to spectrally confirm and map the presence and location of nano and micron scale polymers as they are exposed to many different biological environments including water, plants, soils and live organisms. Examples illustrating the use of this technology to detect and characterize different types of plastics in a wide range of environmental matrixes including plants and whole animal organisms are presented.

Keywords: nanoplastics, darkfield hyperspectral microscopy

APPLICATIONS OF CHLORINE COMPOUNDS IN THE AQUATIC PROCESSING INDUSTRY

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Purpose: Eliminate large populations of microorganisms with the help of antibacterial activity of chlorine compounds and increase the shelf life of many foods, including fishery products. Chlorine compounds are widely used in the food industry to kill bacteria and disinfect products. Aquatic processing operations to maintain hygienic quality requires steps to reduce the microbial load on the surface of the fish and the surfaces in contact with the fish that need to be kept clean. One of the most important aspects of aquaculture industries is the diversity of aquatic species (tens of different species in Iran alone and hundreds of species in the European Union), each of which has different inherent characteristics in terms of microbial load and biohazards, plus high diversity in products. From whole raw fish to ready-to-eat products, require safety and quality. The most common forms of chlorine used in the aquaculture industry include calcium hypochlorite (in the form of granules or powder or liquid) and sodium hypochlorite. The most common method is to use reservoirs to produce a concentrated solution of calcium or sodium hypochlorite salt. Fish and fishery products can be exposed to chlorine-containing compounds through discontinuous processes, by immersion in tubs, or continuously by spraying (with or without pressure). Result: The number of times fish and fishery products can be exposed to chlorine in the interval between catch/harvest discharges to the processing plant will depend on the distribution and marketing chains. The amount of free chlorine remaining in the final product is one of the main and emphasized indicators in the sampling and quality inspection of export seafood, which can lead to rejection and return of goods. It is very important that according to the laws and regulations of most countries, this amount must comply with drinking water standards. Conclusion: Chlorine compounds help to provide a safe product by protecting seafood against microorganisms and disinfecting other contact surfaces of the product, eliminating *E. coli, Salmonella* and a large number of secondary contaminants.

Keywords: microorganisms, antibacterial activity, fishery products, chlorine

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SENSITIVITY OF *ACIPENSER RUTHENUS* EARLY LIFE STAGES TO ENVIRONMENTAL CONCENTRATIONS OF THE TWO FUNGICIDES

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Due to their large applications, pesticides are found almost everywhere and they often end up in rivers, which are the main receptacle of pollutants. For these reasons, waters from basins like the Danube (Romania) or the Garonne (France), which are known to host the last European sturgeons populations, undergo high anthropogenic pressure. Fungicides are compounds commonly used in agriculture and regularly detected, sometimes at high concentrations. They pose a threat on the biota and species of interests like sturgeons, which are already endangered because of the overfishing and physical degradation of their habitat. In this context, we assessed the effects of environmental concentrations of boscalid and imazalil, two fungicides used in western and eastern Europe, on early stages of *Acipenser ruthenus*, a Danube sturgeon specie. For this purpose, an embryo assay was designed consisting of fertilized eggs placed in distinct incubators and exposed to concentrations of 1 µg and 10 µg/L for each fungicide during thirteen days. Mortality rates and hatching kinetic were determined. Conditions with the higher concentrations of 10 µg/L imazalil and 25 µg/L boscalid showed a significant increased mortality and an early hatching compared to the control. Larval heart beats were measured and significant differences were observed between the two fungicides, with different patterns: individuals exposed to boscalid exhibited increased heart rates whereas those exposed to imazalil at high concentration showed decreased heart rates. An increase in the number of developmental abnormalities: hemorrhages, edemas and deformities was observed along with the increase of concentration for each component, especially for imazalil. Also, larvae's biometry was performed and showed significant differences in growth for boscalid exposed larvae which were longer than controls and had also less lipid resources compared to the other conditions. Genetic and behavior analysis will be carried out to better understanding the modes of action of these two fungicides. These primary results indicate that the early life development of *A. ruthenus* could be affected by environmental concentrations of imazalil and boscalid.

Keywords: sturgeons, boscalid, imazalil, fungicides.

SUSTAINABLE APPROACHES FOR REINTEGRATION OF BYPRODUCTS INTO VALUABLE BIOPRODUCTS SESSION

VALORISATION OF SECONDARY FOOD STREAMS. CTNC'S EXPERIENCE

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Funded by the Region of Murcia Development Agency, INFO [1], in 2019, in the VT-ECOCIMUR project a SWOT / SOR Analysis was carried out by CTNC on the state of the Circular Economy in the agri-food sector and in related organizations in the Region of Murcia, following a University of Ghent [2]. methodology, in order to define the strategic priorities of the sector. As result of this study the Attack, Defence, Cleanship and Crisis Strategies were defined. In 2020 in the VICETIR project, CTC defined the actions that should be taken by the Regional Administration in order to promote policies for the sustainability of the Regional agrofood sector. In 2021 the project "Status of the effective valorisation of secondary raw materials of the agri-food industry in the Region of Murcia" VALORMUR will study the volumes and type of secondary raw materials as well as the place where they are generated and the actions that companies are carrying out to minimize the environmental impact.

In the technological field, the main projects related with agrofood sector sustainability will be presented LIFE SOLIEVA, BBI AFTERLIFE, etc.

The wastewater from the processing of table olives (TOPWW) contains a high content of organic matter and salts from the industrial process itself, which make its management difficult. Specifically, the presence of phenolic compounds, such as hydroxytyrosol (2- (3,4-dihydroxyphenyl) ethanol), represents one of the main problems for their treatment, mainly because they are hardly biodegradable and, secondly, because of their important antimicrobial activity, which reduces the efficiency of biological processes in wastewater treatment plants. The LIFE SOLIEVA project has demonstrated the technical viability of recovery of valuable organic compounds in process waters from the production of table olives, achieving extract rich in phenolic compounds. TOPWW have been characterized,

concentrated, atomized and purified, trying to optimize a process of interest to the sector. [3].

Keywords: valorisation, strategy, agrofood

Acknowledgment:

[1] Region of Murcia Development Agency, Instituto de Fomento de la Region de Murcia

[2]. B. Vermeire, X. Gellynck, University of Ghent. 3rd official meeting of the FOOD-CLUSTER Strategic Orientation training session, AGFORISE Regions of Knowledge 7FP project. Tuesday 23 February 2009, Mersin, Turkey

[3].SOLIEVA project is financed by the LIFE Programme 2014-2020 of the European Union for the Environment and Climate Action under the project number LIFE17 ENV/ES/000273.

BIOTICS+: FROM CONCEPTS TO APPLICATIONS FOR GENERATION OF INNOVATIVE TAILORED FUNCTIONAL FOOD

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Metabiotics is a novel concept developed as modern evolution of probiotics, including prebiotics, probiotics, postbiotics and paraprobiotics („ghost probiotics"). They are the structural components of probiotic microorganisms and/or their metabolites and/or signaling molecules with a determined (known) chemical structure with *in vitro* and *in vivo* functional impacts. Metabiotics have attracted much attention because of their long shelf life, safety, and beneficial functional effects, that can optimize host-specific physiological functions, regulator, metabolic and/or behavior reactions connected with the activity of host indigenous microbiota in human or animals. In the last few years, many clinical and preclinical trials have proven the health benefits due to their consumption, like effectiveness in treatment and prevention of alcohol-induced liver disease, respiratory and infectious diseases, viral infection, diarrhea, colitis, atopic dermatitis, dental caries, allergies, inhibition of pathogens, modulation of the immune system and gut microbiota, improvement of anxiety and stress. Most of these researches are related to the direct consumption of metabiotics as components fermented products or ingredients. Their addition in food and feed formulation is also a modern challenge.

Biotics+ is grant financed by a grant of the Ministry of Research, Innovation and Digitization, CNCS/CCCDI – UEFISCDI, number PCE 159/2021, within PNCDI III, PN-III-ID-PCE-2021-3, entitled *Novel transition from probiotics to metabiotics - New emerging concepts for food functionalization as a health promoting strategy.* Biotics+ ambition is to extend the metabiotics application in foods as functional ingredients, as providing several advantages during the industrial handling and commercialization, including the possibility of being added to certain foods considered stressful to probiotics survival, thus, contributing to the expansion of the tailored functional foods market.

Biotics+ proposes a wide application of metabiotics, starting with the selection of proper probiotic lactic acid bacteria, with specific metabolic properties, their use in fermentation processes and processing to metabiotics production in optimized biotechnological conditions. A challenge considered by Biotics+ to be the determination of processing treatments on the stability of the beneficial effects of metabiotics during their shelf life. Biotics+ will promote the concept of tailored functional foods as belonging to functional foods, aiming to sustain the excellence

in science, reflected by the increase in the number of publications with high international impact and patented inventions.

Keywords: probiotics, metabiotics, technological and functional challenges

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TRIBIOTICS – A STRATEGIC COMBINATION FOR DEVELOPING MULTIFUNCTIONAL COMPOSITES

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Several new strategies for developing composites as multifunctional ingredients were developed into the Project *Tribiotic - probiotics, prebiotics, postbiotics - with multiple uses, obtained from by-products resulted from the vegetables industrial processing* - 34-Life, a component project of Prosper Consortium (*Closing value chains in the bioeconomy by obtaining innovative bioproducts demanded by the market,* 10PCCDI/2018 Project Code: PN-III-P1-1.2-PCCDI-2017-0569). The 3-4-Life project aims to develop a dedicated bionanotechnology to produce tribiotic ingredients with enhanced functionality.

The objectives of the 3-4-LIFE research strategy were: (*i*) to recover selected components from agri-food by-products, by extraction and concentration; (*ii*) to develop complex structures, intended lactic acid bacteria (LAB) protection, by coacervation of encapsulated prebiotics together with LAB; (*iii*) to perform co-culture fermentation of yeast (*Yarrowia lypolitica*) and LAB (such as *Lactobacillus paracasei*) on agri-food byproduct substrates (okara and pork land) in order to obtain tribiotics (pre, pro and postbiotics). Different selected bioactives from agri-food by-products, namely yellow onion skins and eggplants peels were extracted using various liquid-solid extraction and assisted methods, such as enzymatic and ultrasound assisted extraction methods, combined with solvents, to maximizes the extraction yield. The extracts were further characterized and used for co-microencapsulation with LAB, in various biopolymeric matrices, including whey protein isolates, chitosan, inulin, pectin, maltodextrin, and whey protein hydrolysates. For example, a flavonoid extract obtained by ethanolic-ultrasound assisted extraction was co-microencapsulated with *Lactobacillus casei* in a combination of whey protein isolate, inulin, and maltodextrin with an encapsulation efficiency of 84.82 ± 0.72% for flavonoids and 72.49 ± 0.11% for LAB. The powder showed a significant antidiabetic and anti-inflammatory potential, with an inhibitory effect on α-amylase, lipase, and lipoxygenase, whereas a controlled release of flavonoids was highlighted in simulated gastro-intestinal environment. In another study, anthocyanins from eggplants peels were extracted and microencapsulated in selected polymers, such as pectin, carboxymethylcellulose and whey proteins hydrolysates by freeze-drying. The anthocyanins were encapsulated with an efficiency up to 77%, highlighting a higher efficiency of carboxymethylcellulose to incorporate anthocyanins. Additionally, the fermentation product obtained by co-cultivation of yeast and LAB proved to be a functional ingredient, with antimicrobial

activity, used for bakery product formulation. Thus, the obtained results confirmed that the obtained bioproducts have a great potential as multifunctional composites with beneficial effect on consumer health.

Keywords: agri-food byproducts, bioactives, fermentation, microencapsulation, multifunctionality

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MULTIFUNCTIONAL COMPOSITES BASED ON CO-MICROENCAPSULATION OF ANTHOCYANINS EXTRACTED FROM BLACK RICE FLOUR AND LACTIC ACID BACTERIA FOR THE FOOD APPLICATIONS

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The main objective of this study was to apply a multi-approach experimental based selection of co-microencapsulation of anthocyanins extracted from black rice flour and lactic acid bacteria to develop functional composites for the food applications. Therefore, by using complex coacervation and freeze-drying, two multi-functional anthocyanins-rich powders were obtained, using different extracts from black rice (*Oryza sativa* L.) and lactic acid bacteria (*Lactobacillus casei*) using a biopolymeric matrix composed of whey proteins and inulin. Two extracts were used, an aqueous extract from the integral black rice flour (Variant 1) and an ethanolic-ultrasound assisted extract from a fraction of the black rice flour (Variant 2), a fraction that was obtained by sieving through a sieve with a 180 mm mesh. The obtained powders were rich in valuable phytochemicals, with encapsulation efficiency for anthocyanins up to 80%. Variant 1 showed a total monomeric anthocyanin content of 102.91±1.83 mg cyanidin 3-*O*-glycoside/g dry weight when compared with Variant 2 of only 27.60±1.36 mg cyanidin 3-*O*-glycoside/g dry weight. Furthermore, the structure and the morphology of the two powders was visualized with confocal microscopy, revealing the presence of the biologically active compounds and the presence of lactic acid bacteria within the biopolymer matrix. Both powders showed a remarkable antioxidant activity of approximately 50 mM Trolox/g D.W. Regarding the *in vitro* digestion of anthocyanins, the biopolymeric matrices displayed a protection effect under gastric conditions, thus allowing their release in the intestinal juice. Furthermore, the phytochemical stability of the powders was also determined during storage, suggesting a higher stability of the antioxidant activity. The obtained results highlighted that the obtained co-microencapsulated powders may be considered as functional food supplements due to their high content of bioactive compounds and the high concentration of lactic acid bacteria, which may bring several health benefits for the human health.

Keywords: microencapsulation, anthocyanins, antioxidant activity, encapsulation efficiency, prebiotic effect.

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FOREST FRUITS PROCESSING BY-PRODUCTS AND CHIA SEEDS AS INGREDIENTS FOR A NEW FUNCTIONAL FOOD

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Aim: Our goal was to develop a new formula for a functional food based on polyphenols and polysaccharides (with emergent antioxidant activity) from forest fruits pomace and from chia seeds. Fruits residues are by-products from agri-food industry which contain important bioactive compounds that can be valorized in other products. We also intended to obtain an encapsulated synergic mixture of these compounds and to use them in a fortified protein bar.

Results: Berry powder is the main polyphenols (PPH) source used in our experiments. Chia seeds are a valuable source of polysaccharides (PSH). Total polyphenols content was determined with Folin-Ciocâlteu reagent and total content of polysaccharides was evaluated using phenol-sulfuric acid and antrone. Antioxidant activity of PSH and PPH and of their combinations with synergic effect was determined using ABTS method. The PPH and PSH combinations with the higher synergic antioxidant activity were encapsulated using whey protein and inulin as matrix. It was observed that the antioxidant activity was maintained after microencapsulation. The microencapsulation is a useful strategy to solve important issues concerning polyphenols: their low bioavailability, the protection during the transit of the gastrointestinal tract and the unpleasant taste. The synergic antioxidant PPH and PSH encapsulated combination was included in a protein bar, resulting an energizing and hypocaloric functional food.

Conclusions: Today there is a great interest in polyphenols and polysaccharides introduction in the everyday diet due to their beneficial effects on human health. When were mixed, polyphenols extracted from berries by-products enhanced the antioxidant activity of the polysaccharides from chia seeds, showing synergic activites. The microencapsulated polyphenols and polysaccharides mixtures (according to our method) keep their antioxidant activity and are suitable for use in a new functional food.

Keywords: functional food, polyphenols, polysaccharides, microencapsulation

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EXTRACTION AND CHARACTERIZATION OF THREE TYPES OF CARROT BY-PRODUCTS

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Daucus carota L. is a root vegetable, cultivated all around Romania, and is consumed in fresh form, in the form of chips, juices, etc. Carrots are one of the most important vegetable sources of biologically active compounds such as flavonoids, saponins, vitamins, polyphenols, carotenoids, fibers, and proanthocyanidins.

In this study, the carrot matrix was used in a fresh, dried, or freeze-dried powder. In order to obtain high functional products, a certain concentration of lactic acid bacteria (LAB) was sprayed onto the obtained samples. The viability of the lactic acid bacteria was evaluated for 21 days with the aid of microbiological methods. The radical scavenging activity of the resulted food products was tested against ABTS and resulting in high antioxidant activity. Furthermore, the phytochemical characterization showed a high content of biologically active compounds (carotenoids, polyphenols, flavonoids, saponins, proanthocyanidins), and the HPLC analysis highlighted the amount of polyphenolic compounds, extracted and identified from the carrot samples. The results showed that the highest quantity of the total carotenoids, total flavonoid content and the antioxidant activity was obtained in the case of the freeze-dried samples with LAB, whereas the high amount of total polyphenols and the proanthocyanidin contents were registered in the case of hot-air dried samples with LAB.

All the data obtained in this study revealed that the drying method and the addition of the LAB influences the phytochemical content of the analyzed samples. In conclusion these results can be applied in the food industries in order to obtain functional products for a wide range of consumers.

Keywords: carrot, bioactive compounds, antioxidant activity

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ANTHOCYANINS AND BIOACTIVE PEPTIDES BASED MULTIFUNCTIONAL INGREDIENTS: AN INTEGRATIVE APPROACH

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An integrative approach was used for the reintegration and derivation of biologically active compounds from various underutilized resources, such as eggplants and sweet whey, with the purpose to explore the enormous health potential of the selected compounds into multifunctional ingredients for food applications. Eggplants are being processed in various ways that lead to significant amounts of by-products. The first step in our approach consisted in the extraction of anthocyanins using four different methods, to collect extracts with high anthocyanins content. For each method, the ethanol concentration, acid, time, and temperature were tested. The chromatographic profile of the extracts evidenced the presence of five individual anthocyanins, with delphinidin 3-*O*-rutinoside being the predominant one. The extracts presented inhibitory activity against lipoxygenase, lipase, α-amylase, and α-glucosidase, thus suggesting a possible involvement in reducing the risk of various disorders associated with metabolic syndrome. The first-order kinetic model was used to predict the changes that can occur in the anthocyanins content and antioxidant activity. The second integrative step consisted of the derivation of bioactive peptides by the enzymatic hydrolysis of whey proteins. Peptides with a molecular mass of 3 kDa were obtained by varying the time and the enzyme/substrate ratio. The protein hydrolysates were analyzed in terms of hydrolysis degree, antioxidant activity, and antimicrobial activity. The 3 kDa peptides were bound with anthocyanins, the binding and thermodynamic parameters providing useful insights for selecting optimum parameters in terms of developing micro and nano targeted delivery systems through encapsulation. The third integrative step was the microencapsulation in different combinations of biopolymers and peptides. The ingredients were analyzed in terms of encapsulation efficiency, phytochemical content, antioxidant activity, *in vitro* digestibility, and storage stability. The exploratory research consisted of testing the multifunctionality of the powders into food matrices. Ice cream and marshmallows enriched with different powder ratios were analyzed in terms of phytochemical content, antioxidant activity, and storage stability. The obtained results highlighted the significant role of bioactive compounds as valuable candidates for the development of added-value food products, based on integrative approaches.

Keywords: eggplant peels, bioactive compounds, peptides, food ingredients

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RED ONION SKINS AS A RICH SOURCE OF ANTHOCYANINS: THERMAL STABILITY AND BIOLOGICAL ACTIVITY

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Onion (*Allium cepa L.*) is one of the oldest cultivated plants used for culinary and medicinal purposes with multiple functional and biological properties. The non-edible portions of the onion bulb, which are considered as by-products of onions are generated through industrial processing and various cooking processes. These by-products could be useful resources for the production of value-added food ingredients and bioactive phenolic compounds. Red onion skins contain significantly higher levels of active phyto-molecules such as polyphenols, flavonoids (especially flavonols and anthocyanins), phenolic acids and alk(en)yl cysteine sulphoxides. These compounds are known for their various biological effects, including anticancer, anti-diabetic, antioxidant, anti-allergic, anti-obesity, anti-inflammatory and antimicrobial effects.

The aim of the present study is to evaluate the thermal stability of the total anthocyanins content and antioxidant activity from red onion skins extract in the temperature range of 75–155 °C, for different heating times (0–60 min). The extract was also tested for its antioxidant and inhibitory properties on enzymes involved in metabolic syndrome, oxidative stress and inflammatory process. The anthocyanin compounds including antioxidant activity were degraded with increasing temperature and time. The thermal degradation of the anthocyanin content and antioxidant activity in the red onion skins extract followed a first-order kinetic reaction model. The temperature dependence degradation was adequately fitted to the Arrhenius model. Additionally, the calculated kinetic and thermodynamic parameters confirm the irreversible degradation of bioactive compounds. The extract presented inhibitory activity against α-glucosidase, α-amylase, lipase and lipoxygenase (LOX), hence suggesting a possible involvement in reducing the risk of various disorders.

Keywords: red onion skins, degradation kinetics, antioxidant activity, enzyme inhibition

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THERMOSTABILITY AND BIOLOGICAL ACTIVITY OF BIOACTIVE COMPOUNDS RECOVERED FROM RED GRAPE SKINS (BĂBEASCĂ NEAGRĂ VARIETY)

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The main purpose of this study was to use red grape skins belonging to the *Băbească neagră* grape variety as a potential source of anthocyanins with biological activity. The first-order kinetic model was used to predict changes that may occur in biologically active compounds from red grape skin extract. The calculated kinetic and thermodynamic parameters confirm the irreversible degradation of phytochemicals. The degradation of monomeric anthocyanins and the antioxidant activity of red grape skin extract of *Băbească neagră* variety at temperatures between 80 and 140 °C increased with increasing temperature, intensifying the degradation process, a phenomenon highlighted by activation energy values (Ea). Activation energy values were 36.63 ± 0.007 kJ/mol for anthocyanin, and 4.53 ± 1.10 kJ/mol for antioxidant activity degradation. Both the temperature and duration of heating significantly impacted the content in bioactive compounds. The extracts also showed inhibitory activity against α-amylase and α-glucosidase, thus suggesting a possible involvement in reducing the risk of developing type II diabetes. The extract showed 95% in vitro inhibitory activity for both α-amylase and α-glucosidase tested.

Keywords: red grape skin; bioactive compounds; anthocyanins; kinetics degradation; biological activity

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OPTIMIZATION OF CONVENTIONAL EXTRACTION OF BETALAIN COMPOUNDS FROM BEETROOT PEELS

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The consumers' interest in the safe food aspects has led to using natural pigments such as betalains in food production technology as an alternative for food additives. Generally, the most common natural dyes include carotenoids, chlorophylls, betalains, anthocyanins, and other flavonoids, which offer a wide range of colors, from green to blue. Among them, betalains, the plant pigments found in beetroot, cactus fruits, amaranth, chard, etc., are increasingly used in the food sector, being recognized by the European Union as food pigments. Red beetroot peels, an industrial waste material, contain mainly ferulic, vanillic, caffeic, p-hydroxybenzoic acids, and betalains, including betacyanin and betaxanthin. Many extraction methods extract the betalains from food waste, but the most used method is conventional solvent extraction. It is widely used due to its efficiency, short extraction time, and low economic costs despite the disadvantages such as the use of large amounts of solvent. The purpose of this study was to use conventional solvent extraction varying five factors (ethanol concentration, citric acid, rotation frequency, temperature, and time) for more efficient extraction of betalain from beetroot peel. The effect of extraction parameters at each extraction step was investigated. In line with this approach, the betalain content in studied samples ranged from 0.49 mg/g and 21.78 mg/g. The calculated equation of betalain extraction from beetroot peel revealed that the highest content with optimum extraction conditions: the extraction process time - 33 min, operating temperature - 22 ºC, and ethanol concentration of 49%.

The study developed an optimized procedure for maximizing the betalain yields on beetroot peel, identifying the ideal combination of extraction parameters.

Keywords: extraction, beetroot, betalains, pigments, optimization

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FUNCTIONAL POTENTIAL OF NATURAL CO-MICROENCAPSUALTED INGREDIENTS BASED ON FLAVONOIDS FROM YELLOW ONION SKINS, WHEY BIOACTIVE PEPTIDES AND LACTIC ACID BACTERIA

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In recent years, the development of a healthier lifestyle, based on the consumption of value-added products, with the potential to lower the risk of specific illness, has become increasingly popular. Onion (*Allium cepa* L.) is one of the major vegetable crops grown in Europe. Onion processing at industrial scale causes large amount of wastes. Therefore, there is a current need to manage onion wastes by recovering important bioactives from plant processing by-products. One of the major objectives of this study was to valorize the phytochemicals from yellow onion skins by extraction, quantification, and co-microencapsulation. Different methods of conventional and modern extraction including enzymes assisted extraction, conventional solvent extraction, ultrasound-assisted extraction, and supercritical fluid extraction, have been used in order to detect the most suitable method for identifying and quantify the antioxidant phytoconstituents.

The results obtained revealed that all the procedures represent suitable techniques for the extraction of the biologically active compounds. The chromatographic profile of extracts obtained from yellow onion skins through various extraction techniques revealed the presence of five essential compounds, mostly in the glycoside form of quercetin. To overcome the well-known poor processing and low bioavailability of flavonoids, various microcapsules delivery systems have been developed, in the following steps. Phytochemicals from yellow onion skins were successfully encapsulated by freeze-drying in different polymeric coating materials, such as whey protein isolate, maltodextrin, and inulin, in different ratios. The investigations of the interactions between proteins and different quercetin extract were performed in order to describe the binding mechanism between flavonoids from yellow onion skins extract and proteins and/or peptides. Polyphenolic extract was also co-microencapsulated with lactic acid bacteria providing prebiotic and cytocompatibility role.

A controlled hydrolysis was also developed to obtain bioactive peptides and to increase the functionality of the final product. The freeze-dried powders were evaluated in terms of encapsulation efficiency, phytochemical profile, antioxidant activity, biological activity, *in vitro* digestibility, whereas the functional potential was tested by adding different ratios in suitable food matrix. The obtained powders

may be a successful candidate for multifunctional ingredients, replacing synthetic dyes used in the food industry, thus contributing to the potential health benefits associated with the consumption of natural antioxidants.

Keywords: flavonoids, yellow onion skins, co-microencapsulation, antioxidant activity, functionalization

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LOW TEMPERATURE SPRAY DRYING OF SOUR CHERRY JUICE CONCENTRATE WITH DAIRY BY-PRODUCTS TO PRODUCE CLEAN LABEL PRODUCT

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The growing consumers' interest in clean labeled products, and also in line with the "zero waste" trend, forces producers to look for new solutions that will respond to market expectations. As a consequence of low glass transition temperature of sugars and acids present in fruit juices, it is necessary to apply carrier agents in order to avoid stickiness and ensure successful spray drying performance. Juice powders most often contain maltodextrin as a carrier. However, due to its high glycemic index, its popularity among consumers has been decreasing. Moreover, achieving the desired technological effect is associated with high addition of a carrier, often over 50% powder solids. Recently, there has been a huge growth of interest in dehumidified air assisted spray drying as a solution to carry out process without stickiness problem, and consequently to lower the carrier content.

Thus, this research focuses on an investigation of the process performance of sour cherry juice concentrate spray drying with the use of dehumidified air (compared to conventional spray drying at high drying temperature), and with "clean label" dairy by-products as carriers. The sour cherry juice concentrate was dried by spray drying it using maltodextrin, and with a blend of maltodextrin with buttermilk, whey and whey protein concentrate powders (1:1 w/w), and with just whey powder as carrier to create a product of a clean label property. The application of dehumidified air allowed to reduce the carrier content down to 30% of powder solids. The mixture of maltodextrin with whey protein concentrate and whey had the best powder recoveries (over 65%). The evidence from this research supports the idea that the addition of whey and whey protein concentrate powders to maltodextrin in order to reduce its content in the product, allows to successfully obtain a high quality product in line with "clean label" and "zero waste" trends.

Keywords: spray drying, dehumidified air, sour cherry juice concentrate, buttermilk, whey

PHYTOCHEMICAL ANALYSIS, ANTIOXIDANT AND PESTICIDE ACTIVITY OF ROSEMARY FLORAL WATERS

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Aim: Floral waters (hydrosols) are recovered during aromatic plants distillation for the extraction of essential oils. This work aimed to evaluate the antioxidant and pesticide potential of hydrosols obtained by distillation of *Rosmarinus officinalis* (rosemary) in correlation with their phytochemical composition, in view of use as natural products intended for pest control in ecoagrosystems.

Results: Rosemary hydrosol obtained by reflux distillation had a composition rich in volatile compounds, as determined by GC-MS, phenolic acids and flavonoids, as identified by HPLC and quantified by Folin-Ciocalteu and respectively aluminium chloride assay. In contrast, steam distilled hydrosol presented traces of volatile compounds, but it was rich in polyphenolic compounds. The antioxidant activity of rosemary hydrosols determined by TEAC, DPPH and CUPRAC assays was found to be positively correlated to their polyphenolic content. Thus, the steam distilled hydrosol had significantly ($p<0.05$) higher antioxidant activity, in comparison to that of the reflux distilled hydrosol and butylated hydroxytoluene, a known synthetic antioxidant. In addition, rosemary hydrosols inhibited acetylcholinesterase activity, indicating their neurotoxic potential and likely applications as biopesticides. This property was mainly based on the polyphenolic content of hydrosols and their capacity to modulate pro-oxidant/antioxidant reactions involved in pest development.

Conclusions: All these results showed that distillation of rosemary plants could provide valuable by-products (hydrosols), in terms of polyphenolic content, antioxidant activity and pesticide potential. The recovery of rosemary hydrosols is recommended, in order to be used as natural ingredients of novel biopesticides useful in the prevention and control of plant diseases, practicing at the same time an ecological agriculture.

Keywords: hydrosol, polyphenols, antioxidants, biopesticides

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THE IMPORTANCE OF BY-PRODUCTS FROM FISH PROCESSING IN THE PRODUCTION OF VALUE-ADDED PRODUCTS

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Purpose: Reduce waste effects and increase added value in Fish processing

In fish processing, large amounts of waste are produced, including water and solids. Solid waste contains 50-70% of the main raw materials, and depending on the process used, this waste will be a mixture of different parts, head, intestines and bones. As a result, fish bones, skin and fins from fish processing waste can be replaced by valuable resources. Also, some species of fish, which are called low-consumption species, are completely discarded due to some inherent characteristics such as small size, dark meat, bone structure, etc. Disposal of these wastes is very difficult and causes environmental pollution, which is one of the biggest concerns in the seafood industry today. If these wastes are used properly, on the one hand, they produce highly economically valuable products and on the other hand, they prevent environmental pollution.

Result: The high rate of production of various products from waste causes the construction of processing plants and ultimately the production of valuable applied products and on the other hand, leads to currency and employment. By-products of fish are rich in oils, minerals, enzymes, pigments and condiments. These wastes are also important in the industry in the production of fertilizers, compost, protein hydrolyzates. Non-nutritional uses include Chitin and Chitosan, carotenoid pigments, extraction of various enzymes, leather, adhesives, pharmaceuticals, cosmetics, fine chemicals, collagen, and gelatin.

Conclusion: Using new methods in fish processing to waste omitting could be essential and vital for economical aspects

Keywords: Fish, Waste, Processing, By-products

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PROSPECTS FOR THE USE OF AGRICULTURAL WASTE AS A SUBSTRATE FOR ACETIC FERMENTATION

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Vinegar production in the Republic of Moldova is small compared to countries such as Italy, Spain and Asian countries, although the process of production and preparation of vinegar is now becoming more and more important. The Republic of Moldova has a great potential of agro-food products for the production of high-quality fruit vinegar. In this work, we investigated the possibility of using agro waste, such as grape pomace, walnut and hazelnut shells, apple woods chips, as a substrate for plantations and the development of acetic acid bacteria. The substrates were pre-dried in an industrial drying oven at a temperature of 32±1°C for 48 h, but for grape pomace, drying was continued until a MC 8-10±1% was reached. As a liquid part, a local white wine of increased acidity with physical and chemical indicators was used: alcohol-12.7%, sucrose-4.4g/L, pH-3.64. The concentration of alcohol is reduced by drinking water to 10%. Before using agro waste as a surface source for the development of vinegar bacteria, they were introduced into a starter culture consisting of untreated white vinegar in a ratio of 1:4. The samples were left for 72 h at a temperature of 25±1°C solid substrate. The method of direct inoculation on solid RAE medium confirmed a decrease in the number of colonies after exposure of the substrate in vinegar. During the acetic fermentation for one month, such values as total titratable acidity, pH, density was monitored. The ATT after a month of fermentation in the sample without pomace was only 3.08%, while the sample with pomace reached 8.04%, i.e. 3 times more. In the sample with walnut and hazelnut shells, the obtained indicators were slightly behind the marc, but the chromatic parameters of the wine before and after the fermentation process, judging by the results of SIELAB and spectrophotometry, were much better. Based on the results obtained, it can be concluded that the use of agro substrate has a positive effect on the fermentation rate and thereby reduces the time for obtaining wine vinegar. This is due to an increase in the contact area of the product with acetic acid bacteria that have settled on the surface of the substrate. The use of grape cake also provides the necessary nutrients for the normal functioning of acetic acid bacteria, and the walnut shell improves the organoleptic characteristics of the finished product.

Keywords: acetic fermentation, wine vinegar, substrate, peel, pomace.

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CARBON FOOTPRINT AND SELECTED PHYSICOCHEMICAL PROPERTIES OF FREEZE-DRIED FRUIT AND VEGETABLE SNACKS OBTAINED WITH FRUIT POMACE AND HYDROCOLLOIDS

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Nowadays, sustainable production is the direction of development of the food industry. Both scientists and industry undertake activities related to the management of food waste and reducing the negative impact on the environment. Fruit pomace is a by-product of industrial juice manufacturing. They are characterized by a high content of nutrients and bioactive compounds, by adding them to food products, it is possible to obtain functional food. The aim of this work was to develop freeze-dried fruit and vegetable snacks with the addition of dried fruit pomace powder and hydrocolloids as structure-forming additives and to compare selected physicochemical properties, energy consumption and carbon footprint of the obtained products. The analysis of the results showed that the products with the addition of fruit pomace were distinguished by a much higher content of dietary fiber, polyphenols and antioxidants compared to the variants using hydrocolloids. The use of various structure-forming additives resulted in significantly different physical properties of the products, such as water activity, density and hardness. The energy consumption measured during the manufacture of the snacks in laboratory scale showed that the largest amount was consumed by the freeze dryer, which also accounted for the largest share of the estimated carbon footprint. The preparation of raw materials had a slight impact on the carbon footprint, therefore, in order to reduce the negative environmental impact of the production of freeze-dried fruit and vegetable snacks, it is necessary to focus on modelling the drying process. In summary, dried fruit pomace powder can be used as a functional additive in freeze-dried fruit and vegetable snacks. Consequently the obtained products have a positive effect on the functioning of the human body, are attractive to consumers and environmentally friendly.

Keywords: freeze-dried snacks, fruit pomace powder, hydrocolloids, physicochemical properties, carbon footprint

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ATTEMPTS TO DEVELOP PRODUCTS FOR SPECIAL NUTRITIONAL PURPOSE: THE CASE OF GLUTEN-FREE AND LOW-GLUTEN PRODUCTS WITH PURPLE CORN FLOUR (*ZEA MAYS* L.)

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In recent years, the significant increase of the incidence of celiac disease has led to the need for a gluten-free product market. Therefore, a study was conducted to develop new products with a low gluten content and gluten-free products, respectively, based on purple corn flour. Purple corn (*Zea mays* L.) is a variety of corn rich in anthocyanins and polyphenols, with potential to add significant value to the product in terms of biologically active compounds content and antioxidant activity. In our study, a preliminary step consisting in extraction and advanced characterization in terms of total monomeric anthocyanins content, total polyphenols content, flavonoids content and antioxidant activity of purple corn flour was performed. The purpose of the advanced characterization was to understand, based on scientific evidence, the compounds responsible for the added value. Subsequently, attempts were made to develop low-gluten and gluten-free biscuits, based on brown rice flour and purple corn flour, considered as gluten-free products. The results highlighted the absence of gluten, whereas the biscuits containing purple corn flour showed significant content in bioactives, such as anthocyanins and higher antioxidant activity. Further, the muffins recipe was used for a low-gluten modeling process, based on purple corn flour, and semolina in a smaller amount, as a glutenic part. These products were also characterized in terms of phytochemical profile and antioxidant capacity. Considering the recipes and technological parameters, the obtained results in our study highlighted the significant potential of purple corn to be used for replacing wheat flour or rice flour, in different ratio, to obtain free- or low-gluten products. Our results are promising, supporting the development of the products with a special nutritional purpose, namely people suffering of gluten intolerance. Additionally, the use of purple corn as of significant source of anthocyanins may be seen as a way to add value to food, due to significant content of biologically active compounds, therefore contributing to the integration of the two concepts, such as *products with a special nutritional purpose* and *foods for health.*

Keywords: purple corn, biscuits, muffins, anthocyanins, free-gluten products, low-gluten

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THE INFLUENCE OF WHEY PROTEIN CONCENTRATE PRETREATMENT ON EDIBLE FILMS PROPERTIES

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Development of edible films intended for food preservation is trending the proactive worldwide attitude of reducing food packaging waste.

Edible films (EF) are an environment- friendly packaging as their constituents are fully biodegradable and, in some cases, they could valorize the industrial waste as is the case of whey protein recovered from the cheese- making process.

The current study evaluated the influence of thermal (TT: 80 ± 0.5°C, 35 min) and high pressure pretreatment (HPP: 600 MPa, 20°C, 20 min) of whey protein concentrate on EFs properties. Homogenous, resistant and flexible whey protein EFs, functionalized with thyme essential oil as antimicrobial agent were evaluated for their mechanical, physicochemical and antimicrobial properties. The capacity of films' structure to retain and release the antimicrobial thyme essential oil was assessed over time in relation with EFs' antimicrobial activity by vapor phase test. Films' properties were evaluated by scanning microscopy, determining water vapor permeability and by studying sorption isotherms. GC/MS revealed the volatile fingerprint of thyme enclosed in the two film structures.

The mix of guar gums used in the film forming solution of the TT and HPT EFs insured a stable structure in time and gave good mechanical resistance characteristics. Similar binding sites for water chemisorption were present in both TT and HPT films. TT films displayed slightly higher vapor antimicrobial activity ($p < 0.05$) compared to HPT films against *Geotrichum candidum*, while HPT films exhibited improved, significantly different vapor antimicrobial effect against *Bacillus cereus* and *Torulopsis stellata* throughout the 14 days of tested storage at 25ºC and 50% RH.

The HPT film structure had a significantly ($p<0.05$) higher capacity to retain volatiles after drying compared to TT films. However, after 14 days of storage the HPT films had less p-cymene and α-terpinene than TT films. During storage HPT films had a weak capacity to retain monoterpenes compared to TT films.

Keywords: thyme; essential oil; edible films; high pressure- thermal treatment; antimicrobial.

Acknowledgment: The authors wish to thank Re-SPIA project, SMIS code 11377, for the research infrastructure provided for this study.

STABILITY OF ENCAPSULATED CAROTENOIDS EXTRACTED FROM SEA BUCKTHORN

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Sea buckthorn (*Elaeagnus rhamnoides* (L.) A. Nelson) is native to Asia and was used mainly by Tibetans and Chinese, due to its many therapeutic properties. In traditional Chinese medicine, sea buckthorn was used to improve the functions of the digestive tract and to strengthen the immune system, but also to treat colds and flu.

The aim of this study was to evaluate the stability of encapsulated carotenoids extracted from sea buckthorn (*Elaeagnus rhamnoides* (L.) A. Nelson).

Extraction of carotenoids from lyophilized sea buckthorn was performed using a mixture of ethyl acetate:hexane (2:1) in an ultrasonic bath at 40 ^{o}C, for 20 min. Microencapsulation of carotenoids from lyophilized sea buckthorn was done using whey/soy protein isolate, chitosan and sunflower oil as encapsulating matrix. After freeze drying, the powders were collected in bags and stored in the refrigerator at 4°C in the dark for stability studies.

The results revealed that the stability of the microencapsulated carotenoids is affected by the type of encapsulating matrix. Powders with whey protein isolate addition were more stable than those with soy protein isolate.

Keywords: carotenoids, sea buckthorn, encapsulation, whey proteins, soy proteins

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FOOD APPLICATIONS OF CORNELIAN CHERRY FRUIT EXTRACT – JELLY FORMULATIONS

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Natural food ingredients are increased in the last few years due to their positive impact to the human health.

The main aim of this study was to create a natural alternative to jellies. Therefore, cornelian cherry fruits extract was used to manufacture jelly candies by using gelatine and agar-agar as gelling agents. The fruit extract was obtained by conventional extraction method at 40ºC, 15 min and 60% ethanol solution. Afterwards, the extract was concentrated at 40 ºC under vacuum condition in order to remove all the liquid. The concentrated extract rich in bioactive compounds, antioxidants and natural pigments was used for the different types of jelly candies. All the samples were tested in order to determine the bioactive compounds concentration and also the colorimetric analyses by CIELAB system method. The results obtained shown the variability of lightness (L* = 36.33 to 79.76), greenness/redness (a*=0.21 to 22.33), blueness/yellowness (b*=3.50 to 17.90), chroma (c*=3.64 to 25.62), hue angle (h*=0.24 to 0.77) and also for ΔE* (43.50 to 79.85). Phytochemical profile relieve that the total antioxidant capacity was 7.50±1.47 mg C3G/g d.w., TAA = 73.03±2.91 mMol TE/g d.w and total falvonoid content, TFC =77.12±3.67 mg QE/g d.w. for the agar-agar jellies candies.

In conclusion, the agar-agar jelly candies presented the highest amount of bioactive compounds, a high level of antioxidant activity and represent an important natural food alternative.

Keywords: cornelian cherry, natural food ingredient, jelly candies, colorimetric analyses

Acknowledgment: The authors are grateful for the technical support offered by the Integrated Center for Research, Expertise and Technological Transfer in Food Industry (http://www.bioaliment.ugal.ro)

HEMICELLULOSE POLYSACCHARIDES A PROMISING SUSTAINABLE MATERIAL FOR FOOD PACKAGING USE

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Hemicelluloses represent an important renewable resource of biopolymers which until few years ago was usually removed from lignocellulosic biomass with lignin during pretreatment and used by conversion into chemicals, fuel and as source of heat energy. Due to their structural varieties and based on excellent biodegradability, biocompatibility, and bioactivity, hemicelluloses and its derivatives have received currently considerable attention in terms of use as value-added materials in various areas, including food packaging applications.

Hemicelluloses are mainly heteropolymers with low molecular weight, highly branched, amorphous in nature, with lower stability than cellulose and having a lower degree of polymerization (about 200), allow an easier industrial utilization comparing with cellulose and lignin. Furthermore, due to their amorphous structure and large side groups substituting for the hydroxyl groups on the C2, C3 and C6, hemicelluloses have a higher solubility and susceptibility to hydrolysis comparing with cellulose.

Xylan polysaccharides are the most abundant hemicelluloses component, being available in large quantity in secondary cell walls of wood, agro-residues (wheat straw, corn stalks and cobs), or as secondary product of pulp and paper industry.

This research work aimed to evaluate the use of wood xylan polysaccharide in composites formula for edible films formation and paper coatings. The polyelectrolyte complexes based on xylan/other biopolymers (i.e. chitosan) and composite coatings with xylan and metallic oxides (i.e ZnO) has been tested. The samples of films and coated papers were evaluated in terms of mechanical, barrier (water, oxygen and water vapor permeability) and antimicrobial properties.

The obtained results are promising to predict that these materials can be used in food packaging applications as competitive and sustainable alternative to the petroleum based materials and to obtain environmentally friendly products according to circular economy policy.

Keywords: hemicellulose, xylan, edible films, paper coatings, food packaging

UTILISATION OF *MALEAE* FAMILY FRUITS BYPRODUCTS AS A VALUABLE SOURCE IN WHITE CHOCOLATE

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The vegetables and fruits processing industry is a significant waste generator such as peels, seeds, and unused pulp that reaches the environment. In processing fruits from the *Maleae* family (quince, apples, pears), their peel and seeds are removed; therefore, they are considered byproducts in the food industry. Many studies have shown that the peel and seeds of quince, apples, and pears are rich in flavoring, colorants, protein, dietary fiber, and antioxidants are a source of natural food additives.

Although white chocolate is a favorite product of many consumers, unlike milk chocolate and dark chocolate, it contains insignificant amounts of fiber and antioxidants.

The study aimed to obtain white chocolate with an increased amount of fiber and antioxidants and, at the same time, to find a way of using the byproducts from the fruit processing industry. For this purpose, the peel and seeds of quince, pears, and apples were dried and ground. The powders obtained were mixed in different proportions and introduced into white chocolate in quantities that varied between 5 and 20 %. The fiber content, antioxidant activity, and sensory characteristics of the obtained products were analyzed. We compared the amount of fiber and antioxidants of enriched white chocolate with milk and dark chocolate.

The results showed that the addition of powder obtained from the peels and seeds of the *Maleae* family fruits could be a viable source of antioxidants and fiber that improve the bioactive value of white chocolate.

The incorporation of different powder mixtures also had a significant effect on the sensory qualities.

Keywords: antioxidant activity, dietary fiber, sensorial analysis.

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IMMUNOMODULATORY PROPERTIES OF SWEET WHEY FROM GREEK CHEESES OF DIFFERENT ANIMAL ORIGIN

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Sweet whey is a by-product derived from the manufacture of cheese or rennet casein by coagulation of milk at pH of 5.5–6.5. With a growth rate of cheese production of 1.2% and the high biological and chemical oxygen demand of whey, new ways of using this by-product have to be found to facilitate a sustainable cheese production. The objective of the study was to evaluate *in vitro* immunomodulatory properties of sweet whey derived from cheese of different animal origin (cow, sheep, goat and mixture of them) after a static three phase simulated *in vitro* digestion in order to mimic oral, gastric and intestinal digestion. Successful digestion was confirmed by SDS-PAGE electrophoresis. In order to better characterize the immunomodulatory properties of sweet whey, were tested on macrophages derived from THP-1 monocytes by PMA stimulation (Mf) which were then activated with LPS (Mf-LPS). Gene expression of inflammation-related cytokines (IL-1β, IL-6, IL-8, IL-10 and TNF-α), inflammation-related enzymes (iNOS and COX-2), and transcription factors (NF-κB, TLR4) were analyzed using RT-qPCR. Overall, the effects were of a mainly anti-inflammatory nature, while regarding the animal origin of the samples there were differences regarding the expression of some targets in Mf and Mf-LPS THP-1 cells. In both non-stimulated THP-1 monocytes and macrophages, IL-8 was the most abundant gene relative to four housekeeping genes, followed by IL-1β and the other genes, respectively. In sum, this study demonstrates that sweet whey regardless of animal origin could be suitable by-product to use as a bio-product that can have a positive effect on consumer health through its immunomodulatory capacity.

Keywords: sweet whey, immunomodulatory, *in vitro*, THP-1

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FUNCTIONAL PROPERTIES OF COMMERCIAL BOVINE OR OVINE/CAPRINE WHEY PROTEIN POWDERS

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Whey, the by-product from cheesemaking, is usually transformed into value-added products with high nutritional properties. Moreover, the whey protein powders (WPP), when added to products of food industry, deliver them their functional properties. The purpose of the present study was to figure out the differences in the functionality of commercial WPP. Seventeen commercial WPP, either of bovine or of ovine/caprine origin, having different protein content, i.e., from 5% (whey powder) to >90% (whey protein isolate) were analyzed. Heat sensitivity (HS) of WPP (solutions 5% and 12% protein) was expressed as the appearance of protein aggregates after heating at 95^{o}C for 5 min. Heat stability (HSt) was measured as the time of first appearance of protein aggregates, i.e., heat coagulation time (HCT) after heating at 120^{o}C. The obtained results showed that the WPP with protein content >65% were more heat sensitive and heat unstable. Wettability (%) seemed to be affected by the protein content and the less protein content the higher wettability. Regarding the solubility, expressed as percentage of the initial total solids, values as high as 96% and 100% were determined. The foaming properties, i.e, foam expansion (FE, % of the initial volume of the WP solution) and foam stability (FS, % of the initial foam volume after 30 min), varied significantly among the different WPP samples and did not show to be affected by the protein content. More specific, foam expansions 0-130% and 45-153% were obtained from WP with 11-12% and 80-82% protein content, respectively. The exceptional high values of FE 130% and 153% concerned specially manufactured WPP that can be applied to food products with high viscosity and serum binding properties. The emulsifying capacity, expressed as emulsifying activity index (EAI), ranged from 4.44 to 8.73 m^2/g and from 11.24 to 20.84 m^2/g for the WPP with 80-82% and 11-12% protein, respectively. Concluding, the commercial WPP with similar protein content have diverse functional properties. This evidences that other factors are interrelated and so more research is needed to create tailored functional properties of the WPP that serve as food ingredient.

Keywords: whey powder, functional properties, whey proteins

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VALUATION OF THE DWARF PALM CHAMAEROPS HUMILIS FROM THE REGION OF TETOUAN IN MOROCCO THROUGH A PHYSICOCHEMICAL CHARACTERIZATION

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Wild edible plants (WAP) are plants that are neither managed nor cultivated, accessible and ready to be consumed. These (WAP) have always been an important source of human food and contribute to nutritional diversification. Today, although Morocco has a rich biodiversity, some plants consumed in the past are less today, due to the food transition, abundance, industrialization..., and therefore they constitute a lost part, in this work we chose the region of Tetouan in the north of the Kingdom, and we targeted the research on the dwarf palm as one of the most responded plants in the mountains of the study area.The objective of this work is to evaluate the ethnobotanical food potential of Chamaerops Humilis as a local wild variety by determining its mode of consumption and some physicochemical parameters that characterize it. A field survey was conducted in the province of Tetouan during 6 months of the year 2019, using a questionnaire to 180 people (men and women) in rural and urban communities, in order to collect detailed information on the consumption and different traditional food uses of saw palmetto, and bring some samples to the laboratory to perform physico-chemical analysis determining the nutritional quality in the bench part. According to the results, this plant has an importance not only in food consumption but also enters the cultural and ecological heritage of the region, among the most relevant physicochemical results are those of the water content (11.30%), the content of total polyphenols (289.63 mg AGEq/100g PS), content of Flavonoids (10.98 mg QcEq/100g PS), pH= 6.15 and a percentage of acidity (0.185 Eq A. Citric). Other biochemical parameters were determined, to complete the work The dwarf palm is among the (PSC) that are part of the biodiversity of the region and their consumption can meet the nutritional needs of the population, to remedy the problem of food deficiencies, hence the need to preserve and encourage its consumption.

Keywords: wild plants; dwarf palm; Tetouan region; biodiversity.

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NEW INSIGHT IN BREAD MAKING USING FUNCTIONAL INGREDIENTS: CASE STUDY WITH BREWER'S SPENT GRAIN

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The brewing industry generates considerable quantities of brewer's spent grain (BSG); a by-product which results from the technological operation of lautering of saccharified mash for separating malt wort. BSG is of high interest in the bakery industry. In this regard, the present study investigates the technological potential of oat-based BSG (O-BGS) and buckwheat-based BSG (BW-BGS) in the bread making as is (nF-BSG) or lactic acid fermented (F-BSG; using 1%w/w natural yogurt culture) in two variants (Var-1: 5%; Var-2:15%; as dry matter) of substituting for wheat flour 650 (according to ash content). Bread control sample was obtained without BGS. The leavening duration and the evaporation coefficient by baking (35 minutes at 210°C) for the dough, weight and volume of bread, moisture, color, porosity, elasticity and total titratable acidity of the crumb were determined, as well as, sensorial analysis of breads was made, according to standard methods for baking industry.

Results of the study clearly demonstrated that BSG, in all its proposed variants, leads to obtaining breads that are sensorial accepted by trained sensory panels, but all buckwheat-based samples were preferred. Also, for both BSGs in their fermented variants, the bread weight is lower, but leavening duration is longer in the case of the use of F1-O-BSG and the lowest for the case of nF1-O-BSG. Total titratable acidity for all bread samples is higher than the control. Moreover, BW-BSG bread samples had higher acidity. Regarding the evaporation coefficient by baking, the highest value was found for nF2 samples, followed by F1 samples. In addition, the buckwheat-based samples give higher values than oat-based samples. These findings are in correlation with the data found for porosity and elasticity of the crumb. Taking into account all the physical-chemical and sensory characteristics determined, the best results were found for the F1-BW-BSG sample, followed by the F1-O-BSG sample. This means that, a degree of substitution of 5% can positively influence on the main quality characteristics of bread. In conclusion, the preliminary results provided by this research confirm the opportunity for this new approach to use lactic acid fermentation for valorization of BSG in the bakery industry.

Keywords: brewer's spent grain (BSG), by-products, brewing, bread making

ANALYSIS OF A SUGAR-FREE QUINCE AND APPLE-BASED MARMALADE

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A sugar-free, pasteurized product without the addition of pectin or other gelling agents was made. For the production of quince and apple-based marmalade were used fresh, whole fruits, some of them raw, some other frozen, with no sulphite preservation.

The importance of bioactive compounds such as flavonoids, phenols, anthocyanins, ascorbic acid and also the antioxidant activity was highlighted in the present study by the valorization of quince, apple, black grape juice and chokeberry. The aim of the study was to characterize the marmalade for its physical-chemical parameters, bioactive compounds and sensory characteristics. The amount of polyphenol, anthocyanin, flavonoid, ascorbic acid and antioxidant activity were evaluated before and after the thermal treatment. Several other analyses such as nutritional and energetic value were performed to provide further information about the quality of the marmalade.

Sensory analysis was made as a preference test for the attributes: taste, aroma, smell, consistency, spreadability, appearance, after-taste and overall impression, made for a 9-point scale. The results are between “I like it moderate” and “I like it very much” for all the attributes.

In the case of marmalade, a decrease of 77.48 % in total anthocyanin content, 30.67 % in ascorbic acid amount and 86.5 % in radical scavenging were determined when reported to fresh and frozen ingredients. Also, we have the surprise to find out that the marmalade had an increased in total flavonoid and total polyphenol content, after the product has been thermally treated.

The results highlighted the use of fresh apple, quince, black grapes juice and frozen chokeberry as ingredients for marmalade producing, due to their particular profile of bioactive compounds.

Keywords: bioactive compounds, antioxidant activity, black grape, chokeberry (*Aronia melanocarpa).*

SCIENCE TO BUSINESS: NETWORKING NEW MODELS FOR FURTHER TRANSITION SESSION

INNOVATIVE PROCESSING SYSTEMS FOR VEGETABLE RAW MATERIALS AND FOOD BY-PRODUCTS FOR BIOACTIVES RECOVERY

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Fruit and vegetable processing generate large amount of by-products in the form of pomace, seeds, skins, peels, residual pulp, etc., accounting for 10–35% of raw mass. Due to the higher content of water, the by-products are susceptible to microbial spoilage, involving a negative environmental impact. The fruit and vegetable by-products have a great potential as a source of natural bioactive compounds (carotenoids, polyphenols, flavonoids and anthocyanins) that can be successfully used to replace various artificial food grade-improving agents and to enrich foods with additional biologically active and nutritious substances. Consumers' belief is that a diet rich in bioactive compounds can help in preventive effect on health problems. In this context, Faculty of Food Science and Engineering from Dunărea de Jos University of Galati implements the project SINOVEG - *Innovative processing systems for vegetable raw materials and food by-products.* The main objective of the project is to develop and to scale-up an innovative process for the extraction of bioactive from by-products based on supercritical fluids extraction, in order to obtain enriched, high quality food-grade extracts. The project involves two components, namely experimental research and industrial development, in order to implement, in Romania, at industrial level the supercritical CO_2 extraction technologies. In the experimental research component, a comparative analysis between the conventional and CO_2 supercritical fluids extraction methods was performed based on design of experiments. Significant differences were found in the phytochemical profile of the sea-buckthorn marc extracts, in terms of total carotenoids and antioxidant activities. For example, in conventional extraction the solid-liquid ratio 5:100 (w/v) with the mixture hexane:acetone (1:3, v/v), temperature of 55°C, and extraction time 480 min., an extract with a content in carotenoids of 21.98 mg/g d.w. was obtained. CO_2 supercritical fluids extraction was tested at different parameters, in terms of pressure, temperature and extraction time, the highest concentration of carotenoids, 219.19 mg/g d.w. being obtained at the pressure of 280 bar, extraction time 90 min. and the temperature 37.5°C with the yield of the extraction 10.60%. Therefore, CO_2 supercritical fluids extraction allowed to obtain a high-quality oleoresin, carotenoid-enriched.

Keywords: SINOVEG, by-products, conventional extraction, bioactives, CO_2 supercritical fluids extraction, innovative technological project.

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SINOVEG PROJECT: INNOVATIVE SYSTEM FOR THE RECOVERY OF VEGETABLE RAW MATERIALS

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Annually, the food industry generates large amounts of fruits and vegetables by-products that contain valuable biologically active compounds such as flavonoids, carotenes, phytosterols and tocopherols. The management of by-products is one of the major challenges of agri-food industries. The valuable molecules generated from fruits and vegetables by-products and wastes can be used for the development of nutraceuticals and active pharmaceutical ingredients.

In this context, in Romania, the project entitled Innovative system for the recovery of vegetable raw materials (acronym SINOVEG) will allow, at the semi-industrial scale, the implementation of the innovative extraction technology with supercritical carbon dioxide in order to obtain high valuable extracts from fruits and vegetable by-products. The main components of the project, experimental development and industrial research, are based on knowledge transfer and collaboration with researchers from the University Dunărea de Jos of Galați, Faculty of Food Science and Engineering.

The innovative process aims and the concept of recovery of different compounds from the wastes open new solutions for the food industry, and related industries. Due to the fact that the supercritical carbon dioxide extracts are pure, the valuable compounds can be directly used in formulated food products or as nutraceuticals. Also, the biologically active compounds can be protected by microencapsulation techniques and then incorporated into high-functional foods products as a result of the consumer's requirements.

Keywords: innovative process, supercritical fluid extraction, raw vegetable material, by-products.

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ATTITUDE OF FOOD PROCESSORS FROM SE ROMANIA REGARDING THE PROMOTION OF TRADITIONAL FOOD

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The project: ”Local development and cross border cooperation in the area of agricultural products and traditional food” - LOC FOOD is Joint Operational Programme Black Sea Basin 2014-2020 is co-financed by the European Union through the European Neighbourhood Instrument and participating countries.The main objective of the project is to put in value the strong tradition of local food production in countries from Black Sea Basin Region (Greece, Romania, Moldova, Ukraine and Bulgaria). Agricultural and food sectors represent relevant economic factors for the development in the area. In order to achieve the objective, the following main tasks will be carried out:

- Identifying the high quality traditional food producers and create a data base with producers and their selected products;
- Promoting local food specialities by producing food guides and encouraging culinary tourism.

To identify the traditional products, the project team prepared a questionnaire with five sections: Sections A – contact information and B – general information on the business should be completed by all respondents. One or more of sections of C – for primary products, D – for processed products, and E – culinary dishes of the area, 300 questionnaires were distributed that should be completed according to the type of products that the business produces. A very high percentage and especially those working in agriculture did not complete the questionnaire citing lack of time. A smaller percentage were not interested. 30 completed the questionnaire of which 5 did not want to be included in database. The study aimed to identify the causes to lead to the reluctance to promote products.

Keywords: traditional food, BSB projects, food processors, farmers

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STRATEGIC AUTONOMY AND FOOD SECURITY AND SUSTAINABILITY

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Background and Aims: This paper aims to explore the concept of "open strategic autonomy" for Europe in terms of food security and future sustainability and to provide forward-looking views and policy recommendations from civil society. In particular, the paper provides "food for thought" on issues arising from recent events such as COVID-19, extreme weather events, cyber-attacks and political/social tensions that could affect food supply.

Strategic autonomy should be seen as an opportunity for the EU to ensure the security of its food supply and to promote its food sustainability standards, in particular in the context of the European Green Deal and the UN Sustainable Development Goals. The EU should safeguard its capacity to set high sustainability and climate standards. The European challenge of food sustainability needs to be addressed both internally and externally, and the paper will also examine possible ways to protect and improve the availability of sustainable food for all Europeans, especially in times of crisis.

Methods and Results: The paper is based on a series of analyses of European legislation, concrete proposals and ideas developed by the European Economic and Social Committee – the EESC in its work.

Conclusions:

- promoting a comprehensive food policy in the EU with the aim of encouraging **healthy diets from sustainable food systems**, linking agriculture to eco-systemic nutrition and services, and ensuring supply chains that protect public health for all segments of European society;
- **enhance** the potential of **short food supply chains** and agroecology;
- including the **Green Deal, F2F and biodiversity** strategies as global sustainability standards in all future EU trade agreements;
- ensure structured involvement and participation of civil society and all stakeholders along the food supply chain, including through the establishment of a **European Food Policy Council.**

Keywords: Green Deal, F2F, strategic autonomy, food security, sustainability.

FOOD INDUSTRY IS TURNING DUE TO ARTIFICIAL INTELLIGENCE AND BIG DATA

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The pace of technological development and velocity of transformations are amazing and unseen before.

The use of Big Data, Artificial Intelligence and Internet of Things in large food industry is the main topic analysed by the paper.

Food industry, animals and plants management are nowadays subject of smart technologies. Sittuated at a cross disciplinary approach, the article aim is WHAT and HOW the use of appropriate software hardware elements improve food management performance but also what skills are required.

The work is a broad analysis which include the journey from shallow learning to deep learning of food industrial applications, namely of AN networks, Big Data and Artificial Inteligence.

The main proposed goal was to identify the cornerstone of using digital tools for the betterment of the food industry and what skills are required for this from its workforce.

Deduction is that, for all above, a robust demand is required for a continuous update of the qualifications, skills and knowledge of workforce in order to create a highly qualified, multi-skilled labor force that can handle all the technological progress undergoing in food industry.

Keywords: food industry, Big Data (BD), Artificial Intelligence (AI) and Internet of Things (IoT), skills

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