IECAN 2025 Conference

The 2nd International Electronic Conference on Antioxidants

07–09 April 2025 | Online

Program and Abstract Book

Organizers

MDPI

antioxidants

Media Partners

nutrients

International Journal of Molecular Sciences

marine drugs

学术会议云 ALLCONFS.ORG

sciforum.net/event/IECAN2025
#IECAN2025

The 2nd International Electronic Conference on Antioxidants

07–09 April 2025 | Online

MDPI

Basel • Beijing • Wuhan • Barcelona • Belgrade • Novi Sad • Cluj • Manchester

Organizing Committee

Conference Chair
Prof. Dr. Alessandra Napolitano

Session Chairs
Dr. Mario Allegra
Dr. Raul Zamora-Ros
Dr. Ren-You Gan
Prof. Dr. Aldrin V. Gomes
Prof. Dr. Jiankang Liu
Prof. Dr. José Ángel Rufián-Henares
Prof. Dr. Vicente Micol
Prof. Dr. Victoria Cachofeiro

Scientific Committee Members
Dr. Antonella D'Anneo
Dr. Enrique Roche Collado
Dr. Ernesto Martínez-Martínez
Dr. Federica Pellati
Dr. Gianluca Rizzo
Dr. Iván Andrés Luzardo Ocampo
Dr. Jayanta Kumar Patra
Dr. María Herranz-López
Dr. Miguel Ángel Prieto Lage
Dr. Raúl González-Domínguez
Dr. Simone Carradori
Dr. Urszula Krupa-Kozak
Dr. Wiesław Oleszek
Dr. Mauro Lombardo
Prof. Dr. Corina Danciu
Prof. Dr. David E. Stec
Prof. Dr. Lucia Panzella
Prof. Dr. Maria Daglia
Prof. Dr. Monica Rosa Loizzo
Prof. Dr. Oleg Paliy
Prof. Dr. Reto Asmis
Prof. Dr. Rosa Tundis
Prof. Dr. Yoav Sharoni

Organised by
MDPI

Conference Secretariat
Email: iecan2025@mdpi.com

Table of Contents

Welcome from the Chair

Dear Colleagues,

You are cordially invited to participate in **The 2nd International Electronic Conference on Antioxidants**. This event will offer researchers working in the field of antioxidants the opportunity to present and discuss their latest research findings.

The conference is organized by the MDPI open-access journal *Antioxidants* and will be held as a three-day event on 7–9 April 2025.

At present, antioxidants encompass a significant area of investigation for researchers from many disciplines, and their importance in a variety of fields, from health and food to innovative materials, is increasingly appreciated.

Surveying the topics of the papers recently contributed to our journal, it appears that the fields covered are diverse and broad. We therefore chose to focus the conference theme on a few topics that are currently gaining considerable interest in order to allow for in-depth discussions among participants.

The implication of oxidative stress in severe pathological conditions at high incidence, such as cardiovascular diseases, or chronic conditions, such as obesity or diabetes, affecting large segments of the population is now largely documented; however, the underlying mechanisms of these diseases and conditions and possible interventions are yet to be defined.

The search for novel antioxidants, either natural or bioinspired, with high bioactivity represents a greatly pursued research goal, but it is the metabolism of these compounds and their effects on the gut microbiome that is perceived as a critical issue to address.

Methods for the efficient recovery of antioxidants from natural sources and possibly agri-food waste and by-products, their testing with robust and reproducible methodologies to allow for comparative evaluation and their use in nutrition, food preservation, biomedical and other applications are issues concentrating the efforts of investigators in the field.

In this edition of the e-conference, we have planned relatively short sessions and a lively discussion to take place after each presentation.

The topics selected for the six planned sessions are as follows:

Session 1. Oxidative Stress in Obesity;
Session 2. Oxidative Stress and Inflammation in Cardiovascular Diseases;
Session 3. Antioxidants in Chronic Disease: From Dietary Prevention to Therapeutic Intervention;
Session 4. Antioxidants Intake and Gut Microbiome;
Session 5. Natural and Synthetic Antioxidants and Antioxidant Enzyme Systems;
Session 6. Antioxidant Extraction, Assay and Industrial Applications.

Accepted abstracts will be published in the proceedings of the conference, and authors will be invited to submit their abstracts as full manuscripts, which will be considered for publication in a Special Issue of *Antioxidants*, with a 20% discount on the APC applied.

Prof. Dr. Alessandra Napolitano
Department of Chemical Sciences,
University of Naples “Federico II”,
Naples, Italy

antioxidants
an Open Access Journal by MDPI

Antioxidants (ISSN 2076-3921), provides an advanced forum for studies related to the science and technology of antioxidants. It publishes research papers, reviews and communications. Our aim is to encourage scientists to publish their experimental and theoretical results in as much detail as possible. There is no restriction on the maximum length of the papers. The full experimental details must be provided so that the results can be reproduced. Electronic files and software regarding the full details of the calculation or experimental procedure, if unable to be published in a normal way, can be deposited as supplementary electronic material.

Journal Webpage: https://www.mdpi.com/journal/antioxidants

Invited Speakers

Dr. Marialucia Gallorini

Department of Pharmacy, “G. d’Annunzio” University of Chieti-Pescara, Chieti, Italy

Prof. Dr. Dejan Reljic

Hector-Center for Nutrition, Exercise and Sports Department of Medicine 1, University Hospital Erlangen Friedrich-Alexander-University Erlangen-Nürnberg, Erlangen, Germany

Dr. Hongyan Liu

Research Center for Plants and Human Health, Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences, Chengdu, China

Prof. Dr. Lucia Panzella

Department of Chemical Sciences, University of Naples “Federico II”, Napoli, Italy

Dr. Iván Andrés Luzardo-Ocampo

Tecnologico de Monterrey, The Institute for Obesity Research, Mexico, Tecnologico de Monterrey, Department of Bioengineering, Monterrey, Mexico

Prof. Dr. Corina Danciu

Head of Department of Pharmacognosy-Phytotherapy, University of Medicine and Pharmacy “Victor Babeș”, Timișoara, Romania

Head of Doctoral School of Pharmacy, University of Medicine and Pharmacy “Victor Babeș”, Timișoara, Romania

Dr. Antonella D'Anneo
Department of Biological, Chemical and Pharmaceutical Sciences and Technologies (SteBiCef), University of Palermo, Palermo, Italy

Prof. Dr. Maria Daglia
Department of Pharmacy, University of Napoli Federico II, Naples, Italy

Dr. Ernesto Martínez-Martínez
Departamento of Physiology School of Medicine, Universidad Complutense, Madrid, CIBERCV, Spain

Dr. María Herranz-López
Instituto de Investigación, Desarrollo e Innovación en Biotecnología Sanitaria de Elche, Universidad Miguel Hernández (UMH), Elche, Spain

Dr. Maria Pilar Francino Puget
Genomics and Health Area of FISABIO-Public Health, Valencian Region Foundation for the Promotion of Health and Biomedical Research (FISABIO), Spain

Program Overview

	7 April	8 April	9 April
Morning	**Session 6.** Antioxidant Extraction, Assay and Industrial Applications (Part 1)	**Session 5.** Natural and Synthetic Antioxidants and Antioxidant Enzyme Systems	**Session 3.** Antioxidants in Chronic Disease: From Dietary Prevention to Therapeutic Intervention
Afternoon	**Session 6.** Antioxidant Extraction, Assay and Industrial Applications (Part 2)	**Session S.** Oxidative Stress in Obesity	**Session 2.** Oxidative Stress and Inflammation in Cardiovascular Diseases **Session 4.** Antioxidants Intake and Gut Microbiome

IECAN 2025 Program

7 April 2025 (Monday)

Session 6. Antioxidant Extraction, Assay and Industrial Applications (Part 1)

Time: 9:00 (CEST, Basel) | 03:00 (EDT, New York) | 15:00 (CST Asia, Beijing)

CEST Time	Speaker	Title
09:00–09:10	**Prof. Dr. Alessandra Napolitano** Conference Chair	Welcome from the Conference Chair
09:10–09:20	**Dr. Ren-You Gan** Session Chair	Welcome from the Session Chair
09:20–09:40	**Dr. Liu Hongyan** Invited Speaker	Antioxidant compounds extraction from thinned unripe kiwifruits: Optimization, identification and bioactivities
09:40–09:55	**Francisco Javier Alvarez-Martinez** Selected Oral Speaker	A new era in plant extract antioxidant capacity optimization
09:55–10:10	**Sadia Zulfiqar** Selected Oral Speaker	Comparison of commonly used methods for efficient extraction and quantification of polyphenols
10:10–10:25	**Milica Vidić** Selected Oral Speaker	Green extraction of antioxidant compound (quercetin) from Salix amplexicaulis species using natural deep eutectic solvents
10:25–10:40	**Celia Mei Moreno González** Selected Oral Speaker	Chitosan-Based Microspheres as Antioxidant Carriers: A Sustainable Approach for Advanced Cosmetic Formulations
10:40–10:55	**Pedro Sousa Sampaio** Selected Oral Speaker	Analysis of the antioxidant effect of macroalgae extracts using Fourier Transform Infrared spectroscopy and machine learning techniques
10:55–11:10	**José Ramón Martínez Guillén** Selected Oral Speaker	Valorization of rice straw through aqueous polyphenol extraction: Optimization, scale-up and potential industrial applications
11:10–11:25	**Reda El Boukhari** Selected Oral Speaker	Patent Landscape Analysis of Antioxidants from Lamiaceae Plants: Innovations and Applications
11:25–11:40	**Melanie Desirée Gomez Herrera** Selected Oral Speaker	Antioxidant activity of casein hydrolysates produced using Bromelia serra leaf extract
11:40–11:55	**Marta Fernández-Oliver** Selected Oral Speaker	Improving olive leaf extract bioavailability through encapsulation: in vitro digestion and intestinal permeability

Session 6. Antioxidant Extraction, Assay and Industrial Applications (Part 2)

Time: 14:00 (CEST, Basel) | 08:00 (EDT, New York) | 20:00 (CST Asia, Beijing)

CEST Time	Speaker	Title
14:00–14:10	**Dr. Ren-You Gan** Session Chair	Welcome from the Session Chair
14:10–14:30	**Prof. Dr. Lucia Panzella** Invited speaker	Natural phenolic polymers: a viable solution to meet the need for multifunctionality in the food, cosmetic, and biomedical sectors
14:30–14:45	**Filipe Jorge Fernandes** Selected Oral Speaker	From Waste to Value: Phenolic Content and Antioxidant Potential in Labdanum Residues via Solid–Liquid and Subcritical Water Extraction
14:45–15:00	**Mariana Lamas** Selected Oral Speaker	The antioxidant potential of Arbutus unedo tree berries from the Natural Park of Montesinho
15:00–15:15	**Amina Azi Madan** Selected Oral Speaker	How different cooking methods can affect the glucosinolates and their degradation product in Brassica vegetebals. Literature review
15:15–15:30	**Maria Carpena** Selected Oral Speaker	Macroalgae as a Source of Antioxidant Compounds: Extraction and Characterization
15:30–15:45	**Ezgi Nur Yuksek** Selected Oral Speaker	Evaluation of Antioxidant Activity and Phenolic Content in Camellia Japonica Leaves: A Step Towards Applications in Functional Foods and Cosmetics
15:45–16:00	**Rita Argenziano** Selected Oral Speaker	Sustainable Recovery of Lignin with Potent Antioxidant Properties from Agrifood Industry By-products by use OF Deep Eutectic Solvents

16:00–16:15	**Dario Donno** Selected Oral Speaker	Agri-food industry by-products from the chestnut supply chain post-harvest: the potential of episperm as a source of antioxidant compounds for human well-being
16:15–16:30	**Rajeshwari Satish Patil** Selected Oral Speaker	Plant-Derived Mucilage: A Natural Antioxidant with Multifunctional Applications in Food, Cosmetics, and Health
16:30–16:45	**Huan Guo** Selected Oral Speaker	Preparation, physicochemical characterization, and application of edible films based on pectins and flavonoids from citrus by-products
16:45–17:00	**Ana Olivia Serra Jorge** Selected Oral Speaker	Protective Antioxidants in Seafood: Supporting Health and Combating Disease

8 April 2025 (Tuesday)

Session 5. Natural and Synthetic Antioxidants and Antioxidant Enzyme Systems

Time: 9:00 (CEST, Basel) | 03:00 (EDT, New York) | 15:00 (CST Asia, Beijing)

CEST Time	Speaker	Title
09:00–09:10	**Dr. Mario Allegra** Session Chair	Welcome from the Session Chair
09:10–09:20	**Dr. Marialucia Gallorini** Invited Speaker	Morphological and functional features triggered by carbonic anhydrase modulation in inflamed cells
09:30–09:45	**Alexandra-Mara Cimpanu** Selected Oral Speaker	The impact of 6-hydroxy-L-nicotine on inflammation in a 5xFAD mouse model of Alzheimer's disease
09:45–10:00	**Ibrahim Gidado** Selected Oral Speaker	Benzimidazole-Based Antioxidants: A Computational Study on Lipoxygenase Inhibition
10:00–10:15	**Alessia Remigante** Selected Oral Speaker	Aging-related oxidative stress impairs structural/functional properties and cell signaling in human red blood cells—unveiling the protective role of Açaì Berry
10:15–10:30	**Savanah Senn** Selected Oral Speaker	Transcriptomic and Metagenomic Studies of Eriodictyon crassifolium
10:30–10:45	**Andrzej Michał Sobański** Selected Oral Speaker	Organic sunscreens and their environmental degradation products: an in silico study of interactions with enzymatic antioxidant systems in the human placenta
10:45–11:00	**Aya Hisham Darawsha** Selected Oral Speaker	Activation of ARE/Nrf2 and inhibition of NFkB are involved in the protective effect of phytonutrients and estradiol in human skin cells under mitochondria-generated oxidative stress
11:00–11:15	**Ilaria D'Agostino** Selected Oral Speaker	Multifunctional Agents in the Treatment of Alzheimer's Disease: A Preliminary Investigational Study
11:15–11:30	**Antonio M. Inarejos Garcia** Selected Oral Speaker	Effects of commercial standardized green rooibos (Aspalathus linearis) powdered extract on zebrafish behavior
11:30–11:45	**Jose Lucas de Oliveira Sousa** Selected Oral Speaker	Antioxidant Effect of Pinene in Biological Systems
11:45–12:00	**Yusuf Jimoh** Selected Oral Speaker	In silico design and discovery of novel 2-pyrazoline methanone derivatives as antioxidant agents for cosmetic applications: A bioinformatics analysis and molecular docking study
12:00–12:20	**Prof. Dr. Corina Danciu** Invited Speaker	Oenothera biennis L oil: in vitro-in ovo correlations

Session 1. Oxidative Stress in Obesity

Time: 14:00 (CEST, Basel) | 08:00 (EDT, New York) | 20:00 (CST Asia, Beijing)

CEST Time	Speaker	Title
14:00–14:10	**Prof. Dr. Vicente Micol &** **Prof. Dr. Victoria Cachofeiro** Session Chairs	Welcome from the Session Chairs
14:10–14:30	**Dr. Ivan Luzardo-Ocampo** Invited Speaker	Anti-obesogenic impact of corn and bean prototypes
14:30–14:50	**Dr. Ernesto Martínez-Martínez** Invited Speaker	Mitotherapy: A Promising Approach against cardiovascular diseases associated with obesity
14:50–15:05	**Jesica Martínez-Godfrey** Selected Oral Speaker	Dietary Polyphenols in Obesity Management: Targeting GLP-1 Secretion and Metabolic Health
15:05–15:20	**Irene Pomares-Bri** Selected Oral Speaker	Evaluating the antioxidant effect of natural compounds in reversing hyperglycemia-induced alterations in a human adipocyte model
15:20–15:35	**Samanta Sarahi Reyes-Flores** Selected Oral Speaker	Reduction in Fat Storage in C. elegans Using Protein- and Polyphenol-Rich Hempseed Kombucha
15:35–15:50	**Kadir Uludag** Selected Oral Speaker	Abnormal Weight and Schizophrenia: Exploring the Interplay and the Role of Antioxidants
15:50–16:05	**Paula De Juan-Maciá** Selected Oral Speaker	Obesity-Driven Tumor Resistance: Role of Hypertrophic Adipocytes and Metabolic Stress

16:05–16:25	**Dr. María Herranz-López** Invited Speaker	Adipose Tissue Dysfunction in Obesity: Lipid Metabolism, Oxidative Stress, and Antioxidant Therapeutic Potential

9 April 2025 (Wednesday)

Session 3. Antioxidants in Chronic Disease: From Dietary Prevention to Therapeutic Intervention

Time: 9:00 (CEST, Basel) | 03:00 (EDT, New York) | 15:00 (CST Asia, Beijing)

CEST Time	Speaker	Title
09:00–09:10	**Prof. Dr. Jiankang Liu & Dr. Raul Zamora-Ros** Session Chairs	Welcome from the Session Chairs
09:10–09:30	**Dr. Antonella D'Anneo** Invited Speaker	Methyl gallate-based strategies: clues of a versatile phytocompound with pleiotropic actions
09:30–09:45	**Shweta Keswani** Selected Oral Speaker	Undertaking a Literature Review: Quercetin, A Flavonoid with Therapeutic Promise in Chronic Illness
09:45–10:00	**Federica Carnemolla** Selected Oral Speaker	Polyphenols as Modulators of Fibrinogen-Driven Neuroinflammation: Implications for Neurodegenerative Disease Prevention
10:00–10:15	**Claudia Milena Ardila Melendez** Selected Oral Speaker	Antioxidant capacity of Colombian tropical fruits with dietary potential to reduce the risk of cardiovascular diseases
10:15–10:30	**Layla Simon** Selected Oral Speaker	The Potential of Curcumin-Enriched Diets for Adults with Colorectal Cancer: A Systematic Review
10:30–10:45	**Cristina Soares** Selected Oral Speaker	Analyzing amino acid profiles of herbal decoctions: understanding their antioxidant potential and role in functional beverages
10:45–11:00	**Sofia Benfeito** Selected Oral Speaker	Addressing Mitochondrial Iron Dysregulation in Friedreich's Ataxia
11:00–11:15	**María Losada Echeberría** Selected Oral Speaker	New Therapeutic Perspectives: Olive Leaf Flavones and Their Synergy in Breast Cancer
11:15–11:30	**Hicham Wahnou** Selected Oral Speaker	Dual Antioxidant and Antibacterial Activities of Natural Compounds: Evaluating Their Efficacy Against Pathogenic Bacteria

Session 2. Oxidative Stress and Inflammation in Cardiovascular Diseases
Session 4. Antioxidants Intake and Gut Microbiome

Time: 14:00 (CEST, Basel) | 08:00 (EDT, New York) | 20:00 (CST Asia, Beijing)

CEST Time	Speaker	Title
14:00–14:10	**Prof. Dr. Aldrin V. Gomes** Session Chair	Welcome from the Session Chair
14:10–14:30	**Prof. Dr. Dejan Reljic** Invited Speaker	The Impact of Targeted Exercise Interventions on Cardiometabolic Health and Inflammation in Morbidly Obese Patients
14:30–14:45	**Serena Borghi** Selected Oral Speaker	A butyrate-rich diet improves redox status and fibrin lysis in Behçet's syndrome patients
14:45–15:00	**Elvira Giurranna** Selected Oral Speaker	ROS-induced fibrinogen alterations in Systemic Lupus Erythematosus patients
15:00–15:15	**Raul Bonet-García** Selected Oral Speaker	Study of the Antioxidant and Cardioprotective Effect of a Combination of Polyphenols from Plants
15:15–15:30	**Yongting Luo** Selected Oral Speaker	Antioxidant functional lipid supplements and cardiovascular risk factors: A systematic review and meta-analysis
15:30–15:50	Break	
15:50–16:00	**Prof. Dr. José Ángel Rufián-Henares** Session Chair	Welcome from the Session Chair
16:00–16:20	**Prof. Dr. Maria Daglia** Invited Speaker	Prebiotic Activity of Polyphenols in Modulating Gut Microbiota
16:20–16:40	**Dr. Maria Pilar Francino Puget** Invited Speaker	Tannins for Gut Microbiome Modulation
16:40–16:55	**Mamatha Bhanu L S** Selected Oral Speaker	Interplay of Gut Microbiota and Neurodegeneration

Session 1. Oxidative Stress in Obesity

sciforum-093463: Abnormal Weight and Schizophrenia: Exploring the Interplay and the Role of Antioxidants

Kadir Uludag

Shanghai Jiao Tong University, School of Medicine, Mental Health Center

Background

Investigating how activities like walking or running can be beneficial in controlling weight and influencing the intensity of symptoms in schizophrenia (SCZ) is valuable. Physical exercise has been recognized as a beneficial intervention for individuals with mental health conditions, including SCZ. Engaging in regular physical activity has been shown to have positive effects on weight management, overall well-being, and symptom reduction in various mental disorders.

Methods

A systematic search of PubMed and Web of Science was conducted using keywords such as "overweight status and schizophrenia symptoms" and "underweight status and schizophrenia symptoms" to identify relevant research articles.

Results

Most of the studies focused on overweight status and obesity, while only a few studies were related to underweight status. The majority of studies found a positive relationship between abnormal weight status and increased severity of SCZ symptoms. Moreover, we have explored the potential involvement of antioxidants in the context of obesity among individuals diagnosed with schizophrenia.

Conclusions

The findings of this paper suggest that both underweight and overweight status are significant risk factors for more severe SCZ symptoms related to cognition and positive and negative symptoms. Therefore, monitoring and managing weight status could be an important aspect of treating SCZ patients to improve their overall quality of life. Additionally, promoting a balanced diet and regular physical activity could also contribute positively to their mental health and symptom management. Additional research can assess the effectiveness of utilizing technology-driven tools like mobile applications or wearable devices to encourage healthy weight control and physical activity in patients with schizophrenia. Incorporating technology into certain therapeutic strategies can improve patient symptom monitoring.

sciforum-111583: Dietary Polyphenols in Obesity Management: Targeting GLP-1 Secretion and Metabolic Health

Jesica Martínez-Godfrey [1,*], Irene Pomares-Bri [2], Paula de Juan-Maciá [2], Mariana Elizalde [3], Jose Maria Azorín [3], Enrique Roche [4], Enrique Barrajón-Catalán [2], Vicente Micol [2] and María Herranz-López [2]

[1] Instituto de Investigación, Desarrollo e Innovación en Biotecnología Sanitaria de Elche, Universidad Miguel Hernández de Elche, Elche (Alicante), 03202, Spain
[2] Instituto de Biología Molecular y Celular, Universidad Miguel Hernández de Elche, Alicante, Spain
[3] Brain-Machine Interface System Lab, Miguel Hernández University of Elche, Alicante, Spain
[4] CIBER, Fisiopatología de la Obesidad y la Nutrición, CIBERobn, Instituto de Salud Carlos III (CB12/03/30038), Spain

Introduction

The global prevalence of obesity continues to rise, with projections indicating that over half of the world's population may be affected by 2035. Obesity is a multifactorial condition closely associated with chronic oxidative stress, resulting from an imbalance between pro-oxidant and antioxidant systems. This oxidative stress exacerbates metabolic dysfunction, interferes with appetite regulation, and promotes weight gain. Conventional weight loss strategies, including calorie restriction and increased physical activity, often prove challenging for individuals with obesity due to persistent hunger and increased food intake (hyperphagia). These issues are primarily driven by elevated orexigenic hormones and reduced anorexigenic signaling, making sustainable weight management difficult. This study aims to explore the therapeutic potential of natural compounds, specifically dietary polyphenols with antioxidant properties, to enhance the secretion of glucagon-like peptide-1 (GLP-1), an anorexigenic hormone that plays a critical role in appetite regulation.

Materials and Methods

An in vitro screening of natural compounds was conducted using NCI-H716 enteroendocrine cells to identify polyphenols with significant GLP-1-stimulating effects. Two polyphenols showing the highest efficacy were selected for further evaluation in a diet-induced obesity mouse model. Mice received oral gavage administration of these polyphenols, and their food intake and metabolic markers, including cholesterol and triglycerides, were monitored.

Results

The selected polyphenols significantly enhanced GLP-1 secretion in vitro in a dose-dependent manner. In the mouse model, these compounds effectively reduced food intake, improved cholesterol levels, and attenuated weight gain, suggesting their therapeutic potential.

Conclusions

Dietary polyphenols with antioxidant and appetite-regulating properties show great potential as a natural strategy to address obesity by enhancing anorexigenic hormone secretion and improving metabolic markers such as cholesterol levels. With further research and clinical validation, these compounds could be developed into nutraceuticals or incorporated into dietary approaches to support sustainable weight management and overall metabolic health.

sciforum-114788: Effect of Coffee and Derivative Consumption on Obesity and Oxidative Stress-Related Disorders: Updated Review

Santa Anabel Hernández [1,*], Vicente Micol [2] and Francisco Javier Alvarez [2]

[1] Faculty of Agricultural and Veterinary Sciences, Autonomous University of Santo Domingo (UASD), Av. Alma Mater, Santo Domingo, Dominican Republic
[2] Institute for Research, Development and Innovation in Health Biotechnology of Elche, Miguel Hernández University of Elche (UMH), Alicante, Spain

Annually, coffee production in the Dominican Republic generates 18,405 tons of byproducts such as husk, pulp, silver skin, and parchment. These residues, rich in polyphenols, offer health benefits due to their ability to alleviate disorders related to obesity, a condition characterized by excess body fat, chronic inflammation, and elevated oxidative stress in adipose tissue. These negative effects can be mitigated by the bioactive compounds found in coffee and its byproducts. This study conducts an exhaustive literature review on the impact of coffee consumption and its byproducts on obesity-related alterations and oxidative stress, enhanced through artificial intelligence. Based on Scopus searches using the keywords "Coffee Therapy", which yielded 1811 articles, downloaded in CSV format, we employed artificial intelligence and natural language processing in Python to generate thematic clusters. Subsequently, 61 articles were selected from the most representative clusters aligning with our research objectives. Chlorogenic acid, a potent antioxidant present in coffee and its byproducts, has proven to be pivotal in the observed benefits for metabolic health. Supplementation with husk extract and green coffee has been shown to significantly reduce body weight, inflammation, and improve metabolic health in obese individuals. This is largely attributed to increased antioxidant defenses, as chlorogenic acid effectively eliminates free radicals, reduces oxidative stress, and enhances insulin sensitivity, factors closely linked to the development of obesity. Moreover, coffee extracts significantly reduced lipid accumulation in 3T3-L1 cells, particularly at higher doses (400 and 800 μg/mL). Additionally, an intake of 400 mg of coffee polyphenols, primarily chlorogenic acid, can significantly improve various metabolic markers, such as glucose levels and lipid profiles. These findings support the recommendation of moderate coffee consumption, of around 2-3 twelve-ounce cups daily, for overall health benefits.

sciforum-111577: Evaluating the antioxidant effect of natural compounds in reversing hyperglycemia-induced alterations in a human adipocyte model

Irene Pomares-Bri [1,*], Jesica Martínez-Godfrey [1], Paula De Juan-Maciá [1], Marta Roca [2], Enrique Barrajón-Catalán [1], Vicente Micol [1] and María Herranz-López [1]

[1] Instituto de Investigación, Desarrollo e Innovación en Biotecnología Sanitaria de Elche, Universidad Miguel Hernández (UMH), 03202 Elche, Spain
[2] Analytical Unit, Medical Research Institute-Hospital La Fe, Av. Fernando Abril Martorell 106, Valencia, 46026, Spain

Introduction

Metabolic stress from prolonged hyperglycemia leads to adipocyte dysfunction, contributing to the pathogenesis of metabolic disorders such as obesity and type 2 diabetes. Numerous studies have shown that natural compounds are promising alternative therapies for alleviating metabolic alterations. However, their effects on human models are limited. Our objectives are to elucidate the metabolic alterations in human adipocytes under hyperglycemic conditions compared to mature adipocytes and to study the potential effect of compound A on antioxidant-related metabolism in hyperglycemic human adipocytes.

Methods

Hypertrophic human Simpson–Golabi–Behmel syndrome (SGBS) adipocytes, obtained by 2-week incubation with 25 mM of glucose, were used as a hyperglycemic model. Compound A was incubated during the last 48 h to study its effect on ROS production, on the expression of key target proteins like AKT (by Western blot), and on the modulation of metabolic pathways by profiling using UPLC-MS.

Results

Our findings revealed profound metabolic disruptions in adipocytes exposed to hyperglycemia, characterized by increased ROS, decreased AKT phosphorylation and adiponectin levels, and the downregulation of multiple metabolites and their associated pathways, like cysteine metabolism. Importantly, treatment with compound A demonstrated marked efficacy in mitigating these metabolic alterations and restoring adipocyte homeostasis. Compound A increased AKT phosphorylation and decreased ROS. Regarding metabolic pathways, it increased metabolites from cysteine and glutathione metabolism, partially reverting metabolic stress through an antioxidant environment.

Conclusions

These results provide insights into the metabolic pathways underlying adipocyte dysfunction in hyperglycemic conditions. In addition, they highlight the potential therapeutic effect of natural compound A in ameliorating metabolic disturbances associated with long-term hyperglycemia.

sciforum-099780: Exploring the Interplay between Gut Microbiota Dysbiosis, Oxidative Stress, and Obesity: Insights from Exercise Interventions

Kadir Uludag

Shanghai Jiao Tong University, School of Medicine, Mental Health Center

Obesity is a health concern associated with various metabolic disorders and chronic low-grade inflammation. Emerging evidence suggests that gut microbiota dysbiosis and oxidative stress play significant roles in the development and progression of obesity. However, the interplay between gut microbiota dysbiosis, oxidative stress, and obesity, particularly in the context of exercise interventions, remains poorly understood. This abstract aims to explore the interplay between these factors and provide insights into the potential mechanisms underlying exercise-mediated effects on gut microbiota, oxidative stress, and obesity.

Exercise interventions have been shown to exert beneficial effects on gut microbiota composition, promoting a diverse and balanced microbial community. These exercise-induced changes in the gut microbiota have been associated with reduced systemic inflammation and oxidative stress markers in obese individuals. Exercise may modulate gut microbiota composition directly through increased intestinal motility and changes in microbial metabolism. Additionally, exercise-induced improvements in metabolic health and reduction in adipose tissue inflammation may indirectly influence gut microbiota diversity and function. Furthermore, it is essential to identify appropriate exercise recommendations, given that endurance activities have proven to be significant for individuals. Consequently, our emphasis will be on endurance exercise. We will additionally consider whether Faecalibacterium prausnitzii, Akkermansia muciniphila, and Bifidobacterium adolescentis are associated with endurance exercise participation.

Exercise-induced improvements in gut microbiota can be attributed to increased intestinal motility, enhanced blood flow to the gut, and alterations in microbial metabolism. Exercise also reduces gut permeability, thereby preventing the translocation of harmful pathogens. These positive changes in gut microbiota composition have been associated with reduced inflammation, improved metabolic health, and enhanced immune function.

Understanding the intricate relationship between gut microbiota dysbiosis, oxidative stress, and obesity in the context of exercise interventions is crucial for developing effective strategies for obesity prevention and management.

sciforum-111697: Obesity-Driven Tumor Resistance: Role of Hypertrophic Adipocytes and Metabolic Stress

Paula De Juan-Maciá [1,*], Irene Pomares-Bri [1], Jesica Martínez-Godfrey [1], María Losada-Echeberría [1], Raúl Bonet-García [1], Celia M. Moreno-González [1], Marta Fernández-Oliver [1], Vicente Micol [1,2], Enrique Barrajón-Catalán [1] and María Herranz-López [1]

[1] Instituto de Investigación, Desarrollo e Innovación en Biotecnología Sanitaria de Elche, Universidad Miguel Hernández (UMH), 03202 Elche, Spain.
[2] CIBEROBN (Physiopathology of Obesity and Nutrition CB12/03/30038), Carlos III Health Institute,28029 Madrid, Spain.

Adipose tissue plays a crucial role in regulating critical biological processes. Dysfunctional adipose tissue observed in obesity fosters a tumor-promoting microenvironment through the release of pro-inflammatory factors and metabolic alterations. These changes enhance the proliferation and migration of tumor cells, as well as their resistance to therapies. This study aims to characterize the interaction model between hypertrophic adipocytes and colon tumor cells. A secondary goal is to evaluate their resistance to antineoplastic drugs such as irinotecan and 5-fluorouracil.

A co-culture model was established between HCT-116 colon tumor cells and mature and hypertrophic adipocytes derived from SGBS preadipocytes. Migration and lipid metabolism were assessed via a Western blot analysis of key proteins, including fibronectin, CPT1, FABP4, pAKT, mTOR, and PPARγ. Reactive oxygen species (ROS) levels were measured, and the mitochondrial metabolic activity in tumor cells was evaluated using a Seahorse analyzer. Additionally, drug resistance was analyzed using cell viability assays and IC50 determination, including the effect of conditioned media (CM) from hypertrophic adipocytes. The impact of CM on the tumor cell cycle was measured with flow cytometry.

The HCT-116 cells co-cultured with hypertrophic adipocytes exhibited morphological and metabolic changes, including spheroid formation and the overexpression of CPT1, pAKT, and mTOR, suggesting increased reliance on fatty acids as an energy source. Tumor cells exposed to CM showed reduced oxidative phosphorylation, consistent with metabolic reprogramming, along with significantly elevated ROS levels. CM exposure also significantly increased resistance to irinotecan and 5-fluorouracil, reflected by higher IC50 values. Furthermore, the CM-treated cells showed a significant arrest in the G0/G1 phase of the cell cycle, potentially linked to the activation of survival pathways. Furthermore, in silico docking was also developed, aiming to identify inhibitors of key metabolic and survival pathways, paving the way for novel therapeutic strategies targeting the adipose–tumor axis in obesity-related cancers.

sciforum-111756: Oxidative Stress, Inflammation, and Obesity: Insights into Mechanisms and Therapeutic Targets

Bhagyashri Sandip Patil *, Javesh Kashinath Patil, Hemangi Somnath Chaudhari and Bhagyashri Sunil Patil

PSGVP MANDAL'S COLLEGE OF PHARMACY, SHAHADA, 425409, DIST NANDURBAR, M.S., INDIA

Due to being correlated with metabolic syndrome, diabetes mellitus, cardiovascular disease, fatty liver disease, and cancer, obesity is a global health issue that predisposes to morbidity and mortality. Obesity can be defined as an excessive amount of fat accretion in the body. According to current research, visceral adipose tissue performs a critical function as an active endocrine organ due to its function in releasing adipokines that facilitate complex physiological events. These adipokines exacerbate both low-grade inflammation and oxidative stress (OS), two key constituents of obesity-related comorbidities. This review summarizes the most recent data on the relationship between inflammation, OS, and diseases linked to obesity, focusing on how OS overexpression causes cellular damage by weakening antioxidant mechanisms. To understand the mechanisms by which OS is related to comorbidities, we assess a wide range of models, including animal models, biochemical analysis, and clinical research. The most important discoveries are that heightened OS exacerbates inflammation and cellular damage by increasing the formation of ROS and weakening antioxidant defenses. Increased lipid peroxidation and oxidative damage in adipose tissue associated with insulin resistance and metabolic dysfunction have been identified through data from research conducted on KKAy mice, a model of diabetes obesity. Adipokines, like adiponectin, have been shown to have protective functions against inflammation and OS. Thereby, some of these candidates may become promising therapeutic targets. Understanding the mechanism of these systems is a must for developing such therapies to decrease OS, redress antioxidant imbalance, and reprogram inflammatory pathways. Such tactics may further augment clinical outcomes and reduce the occurrence of obesity-associated diseases in global populations.

sciforum-111690: Reduction in Fat Storage in *C. elegans* Using Protein- and Polyphenol-Rich Hempseed Kombucha

Samanta Sarahi Reyes-Flores [1,*], Taisa Sabrina Silva Pereira [1] and Chibuike C. Udenigwe [2]

[1] Department of Chemical, Food and Environmental Engineering, University of the Americas Puebla, Puebla, México
[2] School of Nutrition Sciences, Faculty of Health Sciences, University of Ottawa, Ottawa, ON, Canada

Obesity, a widespread global health challenge, is a condition characterized by an excessive accumulation of body fat that poses significant risks to overall health. It is often associated with a wide range of metabolic disorders, including insulin resistance, type 2 diabetes, dyslipidemia, hypertension, and cardiovascular diseases. Functional foods, particularly those enriched with bioactive compounds such as polyphenols and proteins, hold promise as effective tools for addressing obesity-related issues. Moreover, functional foods can address obesity-related comorbidities, such as cardiovascular disease and type 2 diabetes, by reducing markers like LDL cholesterol and fasting blood glucose levels [1,2]. This study evaluated the anti-obesity effects of hempseed-enriched kombucha (HK) using *Caenorhabditis elegans* as a model. The analysis included the quantification of reactive oxygen species (ROS) and the assessment of lipid storage using established staining techniques. First, HK was prepared with a previously developed formula [3] optimized to include hempseeds, and it was fermented for 12 days under controlled conditions until a safe pH (3.5-4.5) was achieved. Antioxidant capacity was analyzed via a 2,2-Diphenyl-1-picrylhydrazyl radical scavenging assay (DPPH+), Ferric Reducing Antioxidant Power (FRAP) assays, and a *C. elegan* in vivo assay, while fat storage reduction was assessed using Nile-Red fluorescence microscopy in daf-2 mutants. HK demonstrated significantly higher antioxidant activity (DPPH+ inhibition: 56%) compared to from conventional kombucha (K) (34% inhibition). HK significantly reduced reactive oxygen species (ROS) in *C. elegans*, showing lower fluorescence intensity in ROS assays compared to K. HK also reduced fat storage in *C. elegans* by 80-85%, outperforming K, which achieved a 60-65% reduction compared to glucose controls (p 0.05). These findings suggest that the bioactive components in HK may enhance lipid metabolism through antioxidant mechanisms [4,5]. This research highlights the potential of hempseed-enriched kombucha as a functional beverage for managing obesity while contributing to sustainable health solutions.

Session 2. Oxidative Stress and Inflammation in Cardiovascular Diseases

sciforum-111752: Study of the Antioxidant and Cardioprotective Effect of a Combination of Polyphenols from Plants

Raul Bonet-García *, María Losada-Echeberría, Paula De Juan-Maciá, Marta Fernández-Oliver, Enrique Barrajón-Catalán, Vicente Micol and María Herranz-López

Universidad Miguel Hernández de Elche, Instituto de Investigación, Desarrollo e Innovación en Biotecnología Sanitaria de Elche (IDiBE)

Metabolic syndrome is a global public health problem that significantly increases a person's risk of developing cardiovascular diseases, which are among the leading causes of mortality worldwide. It is a multifactorial disorder characterized by the presence of abdominal obesity, dyslipidemia, insulin resistance, and endothelial dysfunction. The main therapeutic approaches to treating this condition focus on lifestyle modifications, including diet and exercise, as well as pharmacotherapy. However, these treatments often have limitations in their efficacy and adherence, highlighting the need for alternative or complementary approaches. One promising strategy is the use of natural compounds that could reduce the risk and could also prevent the progression of metabolic syndrome and its associated issues.

This research specifically investigates the potential therapeutic effects of a combination of lemon verbena and hibiscus flower extracts for managing metabolic syndrome [1]. The focus is on polyphenolic extracts, since polyphenols are known for their antioxidant, anti-inflammatory, and cardioprotective properties.

In this study, a comprehensive analysis of oxidative stress was conducted by assessing the intracellular generation of reactive oxygen species (ROS), the mass of the endoplasmic reticulum, and the mitochondrial membrane potential. Additionally, vascular, oxidative, and metabolic markers such as eNOS, Nrf2, Sirt-1, and PGC-1α were evaluated in an endothelial cell model under glucotoxicity conditions. The goal was to identify the mechanisms through which this combination of extracts exerts its effects. The results indicate a significant antioxidant and cardioprotective effect in the vascular endothelium, as well as a potential anti-inflammatory effect, which suggests that this combination of polyphenols could be a promising natural therapy for managing metabolic syndrome.

Reference

1. Herranz-López, M.; Olivares-Vicente, M.; Boix-Castejón, M.; Caturla, N.; Roche, E.; Micol, V. Differential Effects of a Combination of Hibiscus Sabdariffa and Lippia Citriodora Polyphenols in Overweight/Obese Subjects: A Randomized Controlled Trial. Scientific Reports 2019, 9, doi:10.1038/s41598-019-39159-5.

sciforum-114081: A butyrate-rich diet improves redox status and fibrin lysis in Behçet's syndrome patients

Serena Borghi *, Flavia Rita Argento, Elvira Giurranna, Francesca Nencini, Ilenia Barbaro, Federica Carnemolla, Manuela Leri, Niccolò Taddei, Monica Bucciantini, Matteo Becatti and Claudia Fiorillo

Department of Experimental Clinical Biomedical Sciences "Mario Serio", University of Firenze, Firenze, Italy

Introduction

Behçet's syndrome (BS) is a systemic vasculitis of unknown etiology characterized as a multisystemic immune-inflammatory disorder affecting vessels of all sizes and frequently complicated by thrombosis. Systemic redox imbalance and heightened neutrophil activation in BS patients are believed to contribute to impaired coagulation. Our group have already demonstrated an altered fibrinogen structure and reduced fibrin susceptibility to plasmin-induced lysis in BS patients, primarily due to increased reactive oxygen species (ROS) production by neutrophils. This supports the idea that BS serves as a model for inflammation-driven thrombosis. Moreover, BS has been associated with a peculiar dysbiosis in the gut microbial ecosystem, represented by a depletion in the Clostridium cluster, involved in short-chain fatty acid (SCFA) production. Among SCFAs, patients show a decrease in the production of butyrate, which exerts anti-inflammatory and trophic activity.

Methods

To explore the relationship between butyrate, blood redox balance, and cardiovascular risk, we examined the effects of a 3-month butyrate-enriched diet in 30 bariatric surgery (BS) patients. Participants were randomly divided into two groups: 15 received oral butyrate supplementation (2.4 g/day), while 15 followed a lacto-ovo-vegetarian diet rich in insulin and resistant starch, which enhance butyrate production through fermentation. At baseline (T0) and after the intervention (T3), we assessed leukocyte intracellular ROS production, plasma malondialdehyde (MDA) levels as a marker of lipid peroxidation, and plasma total antioxidant capacity (TAC). Additionally, we evaluated fibrin susceptibility to plasmin-induced lysis using purified fibrinogen fractions.

Results

Both butyrate-enriched interventions led to significant reductions in leukocyte ROS production and plasma lipid peroxidation, alongside an increase in plasma total antioxidant capacity. Importantly, fibrin susceptibility to plasmin-induced lysis showed marked improvement in both groups at T3 compared to T0.

Conclusions

Our findings suggest that a butyrate-enriched diet enhances blood redox balance and promotes fibrin degradation, highlighting its potential role in cardiovascular disease prevention.

sciforum-098271: Antioxidant functional lipid supplements and cardiovascular risk factors: A systematic review and meta-analysis

Yongting Luo

Department of Nutrition and Health, China Agricultural University, China

Antioxidant functional lipid supplements have been proven to be effective in reducing cardiovascular risks. However, the efficacy of functional lipids with antioxidant properties in reducing cardiovascular risk has not been consistent. To reconcile the inconsistencies in the literature regarding the role of antioxidant functional lipid supplementation in the development of health outcomes, we conducted a systematic review and meta-analysis of all available RCTs to investigate the effect of interventions with functional lipids with antioxidant properties on CVD risk factors. Randomized controlled trials (RCTs) reporting estimates for the effects of antioxidant functional lipid supplementation on cardiometabolic risk factors published up to May 1st, 2024, were searched. Overall, antioxidant functional lipid supplementation, compared with placebo, had favorable effects on systolic blood pressure (lycopene: -1.95[-3.54, -0.36]mmHg), low-density lipoprotein cholesterol (n6 fatty acid: -0.39[-0.71,-0.06]mmol/L; astaxanthin: -0.11[-0.21, -0.01]mmol/L), high-density lipoprotein cholesterol (n3 fatty acid: 0.20[0.13, 0.27]mmol/L; n6 fatty acid: 0.08[0.01, 0.14]mmol/L; astaxanthin: 0.13[0.05, 0.21]mmol/L), total cholesterol (n6 fatty acid: -0.24[-0.37, -0.11]mmol/L; astaxanthin: -0.22[-0.32, -0.12]mmol/L; beta-carotene: -0.13[-0.23, -0.04]mmol/L), triglyceride (n3 fatty acid: -0.37[-0.47,-0.28]mmol/L; astaxanthin: -0.46[-0.83, -0.10]mmol/L) and fasting blood insulin (astaxanthin: -2.66[-3.98, -1.34]pmol/L). The benefits of antioxidant functional lipid supplementation appeared to be most evidenced in blood pressure and blood lipids in participants with different cardiometabolic health statuses. Notably, n9 fatty acid increased triglyceride and hemoglobin A1C, which increase CVD risk, in the total population. These data suggest that antioxidant functional lipid supplementation ameliorates cardiometabolic risk factors, while its effect may depend on the type and cardiometabolic health status. Long-term RCTs are needed in the future to corroborate risk-to-benefit ratios across different antioxidant functional lipid supplementation settings.

sciforum-114078: ROS-induced fibrinogen alterations in Systemic Lupus Erythematosus patients

Elvira Giurranna *, Serena Borghi, Francesca Nencini, Flavia Rita Argento, Ilenia Barbaro, Manuela Leri, Federica Carnemolla, Niccolò Taddei, Claudia Fiorillo, Monica Bucciantini and Matteo Becatti

Department of Experimental and Clinical Biomedical Sciences "Mario Serio", University of Firenze, Firenze, Italy.

Introduction

Systemic Lupus Erythematosus (SLE) is a chronic autoimmune disease characterised by dysregulation of the immune system, production of self-reactive antibodies and an inflammatory state in organs and tissues. Oxidative stress has been implicated in the pathogenesis of cardiovascular events in SLE, promoting tissue injury and inflammation. Thrombosis is a well-known clinical feature in SLE but, despite the large number of risk factors, its underlying pathogenetic mechanisms are far to be understood. This study aimed to explore how oxidative changes in the structure and function of fibrinogen may contribute to the development of atherothrombosis in SLE.

Methods

Here, we recruited 144 adult SLE patients and 90 non-SLE controls. We assayed systemic redox status and, in purified fibrinogen fractions, we explored fibrinogen functional and structural features.

Results

Compared to the control group, SLE patients showed higher leukocyte ROS production. This increase was accompanied by higher plasma lipid peroxidation, decreased antioxidant defenses, and increased fibrinogen oxidation. Additionally, SLE patients displayed significant fibrinogen structural alterations and changes in blood clot architecture, characterized by lower porosity and a denser fibrin network with thinner fibrin fibers. Notably, functional properties of fibrinogen, such as thrombin-induced fibrin polymerization and susceptibility to plasmin-induced lysis, were more markedly affected in SLE patients than in controls. These structural and functional fibrinogen changes strongly correlated with redox parameters, which were also associated with SLE disease activity.

Conclusions

These data suggest that, in SLE patients, ROS induce structural and functional changes in fibrinogen. This could represent a new pathogenetic mechanism underlying atherothrombosis in SLE.

sciforum-114060: Ruxolitinib mitigates oxidative stress and ROS-induced structural and functional fibrinogen alterations in primary myelofibrosis.

Francesca Nencini [1,*], Serena Borghi [1], Elvira Giurranna [1], Flavia Rita Argento [1], Eleonora Fini [1], Daniele Tibullo [2], Giuseppe Alberto Palumbo [3], Cesarina Giallongo [3], Anna Longo [4], Andrea Duminuco [5], Francesco Di Raimondo [5], Enrico Alberto La Spina [2], Giovanni Li Volti [2], Manuela Leri [1], Monica Bucciantini [1], Claudia Fiorillo [1], Niccolò Taddei [1] and Matteo Becatti [1]

[1] Department of Experimental and Clinical Biomedical Sciences "Mario Serio", University of Firenze, Firenze, Italy
[2] Department of Biomedical and Biotechnological Sciences, Division of Medical Biochemistry, University of Catania, Via S. Sofia 97, 95123 Catania, Italy
[3] Department of Medical and Surgical Sciences and Advanced Technologies "G.F. Ingrassia", Division of Hematology, University of Catania, Via S. Sofia 87, 95123 Catania, Italy.
[4] Hematology Unit with BMT, A.O.U. Policlinico "G. Rodolico-San Marco", Via S. Sofia 78, 95123 Catania, Italy.
[5] Dipartimento di Specialità Medico-Chirurgiche, CHIRMED, University of Catania, Catania, Italy.

Introduction

Myelofibrosis (MF) is a myeloproliferative neoplasm characterized by clonal myeloproliferation, bone marrow fibrosis, extramedullary hematopoiesis, and abnormal inflammation. About 90% of MF patients carry mutations in the JAK2, CALR, or MPL genes. Among these, JAK2 mutations promote cytokine independence, constitutive activation of STAT proteins, and increased reactive oxygen species (ROS) production within hematopoietic stem cells. Excessive ROS and inflammation are potential triggers for thrombotic events, a leading cause of morbidity and mortality in myeloproliferative neoplasm patients.

To explore the mechanisms of inflammation-induced thrombosis in MF, we analyzed oxidation-induced fibrinogen alterations in MF patients compared to healthy controls and the effects of treatment with Ruxolitinib, a first-in-class JAK inhibitor.

Methods

This study included 20 primary MF patients and 20 age- and sex-matched healthy controls. Plasma redox status and structural and functional fibrinogen alterations were assessed in both primary MF patients (before and after Ruxolitinib treatment) and controls.

Results

MF patients displayed a significant increase in plasma lipid peroxidation and nitrate/nitrite levels, associated with a reduced total antioxidant capacity and free thiol plasma content. Oxidative imbalance was associated with fibrinogen oxidation, resulting in structural and functional alterations. Structural changes impaired fibrinogen polymerization into fibrin and reduced fibrin susceptibility to plasmin-induced lysis. A positive correlation between fibrin resistance to plasmin digestion and plasma oxidative stress was observed. Patients treated with Ruxolitinib exhibited significant improvements in redox status, as well as in fibrinogen structure and function.

Conclusions

MF patients exhibit a prothrombotic profile sustained by oxidative modifications of fibrinogen. Preliminary findings suggest that Ruxolitinib may improve redox balance and provide cardiovascular protection in these patients.

sciforum-114138: The Role of Oxidative Stress in T2DM-Associated CAD: Pathways and Biomarkers for Clinical Advancements, Early Diagnosis, and Prognosis

Shubhra Vats * and Dhiraj Kishore

Department of General Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh - 221005, India

Introduction

Type 2 diabetes mellitus (T2DM) affects 462 million people globally and is linked to complications like retinopathy, nephropathy, neuropathy, and coronary artery disease (CAD). T2DM increases CAD risk, contributing to 75% of related mortality. Genetic predispositions and distinct mechanisms differentiate DM-CAD from other forms, such as CAD caused by hypertension or degenerative changes, requiring gene expression profiling and transcriptome and reactome analyses to identify and establish molecular markers and improve its diagnosis, prognosis, and treatment strategies. Methods: The Gene Expression Omnibus (GEO) datasets, GSE250283 and GSE90074, were used to identify the differentially expressed genes involved in DM-CAD. Biological targets were identified that coincided with the identified differentially expressed genes. The biological pathways were analyzed using KEGG, and hub genes were identified for a further functional and signaling pathway analysis. Results: Several differentially expressed gene biomarkers were identified between the control and DM and DM-CAD. NLRP3, TLR4, STAT3, IL6, TNF-α, and NF-κB were found to be upregulated, while PPARG, SIRT1, and ADIPOR1 were downregulated, indicating significant pathways with involvement, including the oxidative stress response, JAK-STAT signaling, and insulin resistance and mitochondrial dysfunction.

Conclusions

Oxidative stress emerges as a critical driver of T2DM-CAD pathogenesis, influencing inflammatory pathways and metabolic dysfunction. Genes such as SOD2, CAT, and GPX1 highlight disruptions in antioxidant defense mechanisms, aligning with mitochondrial dysfunction. Elevated STAT3 expression in the JAK-STAT pathway and NLRP3 activation further exacerbate oxidative damage and inflammation. Meanwhile, the downregulation of SIRT1 and ADIPOQ underscores impaired glucose regulation and insulin sensitivity. These findings position oxidative stress as a key therapeutic target, alongside inflammasome and immune signaling pathways like the JAK-STAT pathway as novel therapeutic targets for mitigating T2DM-CAD's severity.

Session 3. Antioxidants in Chronic Disease: From Dietary Prevention to Therapeutic Intervention

sciforum-114161: Actinidia arguta: A Natural Ally in Cutaneous Melanoma combat

Filipa Teixeira *, Marta Oliveira and Francisca Rodrigues

REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Portugal

Cutaneous melanoma (CM) is the deadliest form of skin cancer, with a high metastatic potential and notable therapeutic resistance [1, 2]. As melanoma cellsoriginate from epidermal melanocytes, multiple development processes are shared with healthy cells [1]. Alterations in signaling pathways within pigment-producing melanocytes, as well as mutations in specific genes, may lead to impaired cell proliferation, disruption of cell cycle regulation and increased resistance to apoptosis, allowing for invasion and metastasis [3, 4]. For example, mutations in NRAS and BRAF genes lead to uncontrolled proliferation by activating MAPK and PI3K/AKT pathways [2, 3]. The treatment of CM poses considerable challenges due to its complex biology and ability to develop resistance to conventional therapies [5, 6]. Current CM treatments often include surgical excision, radiation, chemotherapy, immunotherapies and targeted molecular therapies, with special emphasis on the latter that have been focusing on key molecules, proteins and components of various signaling pathways regulating the development and progression of CM [6, 7]. In recent years, topical treatments have become the standard care for the treatment of early-stage melanoma or melanoma in situ, offering a less invasive alternative to surgery [7, 8]. Recent research has been exploring the potential of natural compounds and their analogues in the treatment of CM. In this context, *Actinidia arguta* arise as an excellent candidate due to its rich composition in phenolic acids, flavonoids, vitamins and other bioactive compounds [9, 10], with outstanding antioxidant, anti-inflammatory and anti-cancer properties [11, 12]. This work aims to explore the potential benefits of bioactive compounds from *A. arguta* by-products against CM. By offering new insights into the use of these compounds as complementary or alternative therapies, this study seeks to encourage scientists to develop new CM therapeutic strategies that are more effective and less toxic than conventional ones, providing a glimmer of hope in the fight against CM.

sciforum-113115: The Potential of Curcumin-Enriched Diets for Adults with Colorectal Cancer: A Systematic Review

Constanza Mena, Maria Neira, Keila Torres and Layla Simon *

Nutrition and Dietetic School, Universidad Finis Terrae, Santiago, 7501015, Chile.

Colorectal cancer is one of the most prevalent malignancies and the second leading cause of cancer-related deaths worldwide. Conventional treatments such as chemotherapy and radiotherapy are often associated with severe side effects and limited effectiveness. On the other hand, curcumin, a polyphenol derived from *Curcuma longa*, has demonstrated anti-inflammatory and anticancer properties. However, the effects of curcumin on colorectal cancer remain unknown. A systematic review of recent scientific literature was conducted following PRISMA guidelines to evaluate the benefits of a curcumin-enriched diet for adults with colorectal cancer. Articles published between 2018 and 2024 were retrieved from PubMed, SciELO, Google Scholar, and Scopus. A total of 129 articles were identified during the initial search process. In the first screening phase, 19 duplicate articles were removed. Subsequently, in the second screening phase, an evaluation of titles and abstracts excluded an additional 95 articles. Ultimately, 15 original articles met the inclusion criteria and were used for the final analysis. Studies meeting inclusion criteria focused on curcumin, adults, and colorectal cancer outcomes. Data on survival rates, quality of life, tumor reduction, and inflammatory markers were extracted and analyzed. Administration of curcumin was associated with improved survival rates, enhanced quality of life, tumor reduction, and anti-inflammatory effects. Its mechanisms of action include inhibiting cellular proliferation, inducing apoptosis, and reducing oxidative stress. However, limited bioavailability and potential side effects, including gastrointestinal discomfort, were noted. A curcumin-enriched diet may serve as an effective adjunct therapy for colorectal cancer patients. Future research should focus on optimizing curcumin formulations to address bioavailability and long-term safety concerns.

sciforum-113911: Addressing Mitochondrial Iron Dysregulation in Friedreich's Ataxia

Sofia Benfeito [1,*], Carla Lima [1], Catarina Alves [1], Daniel Chavarria [1], Fernando Cagide [1], Antonio Currais [2], Pamela Maher [2], José Teixeira [3], Paulo Oliveira [3] and Fernanda Borges [1]

[1] CIQUP-IMS/Department of Chemistry and Biochemistry, Faculty of Sciences of University of Porto, Porto, Portugal
[2] Cellular Neurobiology Laboratory, The Salk Institute for Biological Studies, 10010 North Torrey Pines Road, La Jolla, CA 92037, USA
[3] CNC- Center for Neuroscience and Cell Biology, CIBB-Centre for Innovative Biomedicine and Biotechnology, University of Coimbra, Coimbra, Portugal

Introduction

Friedreich's Ataxia (FRDA) is an autosomal recessive neurodegenerative disorder characterized by impaired muscle coordination and hypertrophic cardiomyopathy, affecting 1 in 50,000 individuals worldwide. It results from GAA triplet expansion in the FXN gene, reducing frataxin levels and causing mitochondrial dysfunction, oxidative stress and oxytosis/ferroptosis, a form of iron-dependent regulated cell death. Although the FDA-approved omaveloxolone slows disease progression via NRF2 activation, its association with elevated liver enzymes limits its clinical use, and no treatments currently effectively address the underlying causes of FRDA.

Rationale

Deferiprone (DFP), an iron chelator, has demonstrated potential in managing FRDA by crossing physiological barriers and targeting intracellular iron pools. However, DFP lacks mitochondrial specificity and results from its phase II trial for FRDA (NCT00897221) remain unpublished. Therefore, we hypothesize that selectively targeting iron chelators to mitochondria can prevent iron-induced toxicity, mitochondrial dysfunction and oxytosis/ferroptosis.

Objectives

We aimed to design and synthesize DFP-based compounds to improve mitochondrial targeting, combining iron chelating and antioxidant properties to address mitochondrial dysfunction and prevent oxytosis/ferroptosis in FRDA.

Methods

DFP derivatives were synthesized and evaluated for antioxidant activity using the ORAC assay to measure the peroxyl radical scavenging activity. Iron chelating properties were recorded using UV-Vis spectroscopy in the absence/presence of $FeSO_4$. The active compounds were further tested for their ability to protect neuronal cells (HT22) from oxytosis/ferroptosis induced by glutamate, erastin or RSL3 insults.

Results

DFP derivatives exhibited similar antioxidant activity to the parent DFP, indicating that structural modifications did not alter peroxyl radical neutralization and effectively chelated Fe^{2+}. Some compounds showed significant protection against oxytosis/ferroptosis in HT22 cells, with the best compound presenting EC_{50}s of 5.10 μM, 6.0 μM and 5.8 μM against glutamate, erastin and RSL3, respectively.

Conclusions

Novel DFP derivatives provide a multitarget strategy to address mitochondrial dysfunction in FRDA, offering a promising new safety class of therapeutic agents with combined iron chelation, antioxidant and neuroprotective properties.

sciforum-112388: Analyzing amino acid profiles of herbal decoctions: understanding their antioxidant potential and role in functional beverages

Maria Fernanda Nogueira [1], Francisca Santos [1], Stephanie Morais [1], Mónica Dias Teixeira [1,2], Cristina Soares [1,*], Cristina Delerue-Matos [1] and Clara Grosso [1]

[1] REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Rua Dr. António Bernardino de Almeida, 431, 4249-015 Porto, Portugal
[2] NICiTeS – Núcleo de Investigação em Ciências e Tecnologias da Saúde, Escola Superior de Saúde Ribeiro Sanches, Lisboa, Portugal

Herbal decoctions are widely consumed for their health benefits and flavour. These beverages are known for their natural antioxidant properties, primarily linked to their phytochemical and nutrient content, including amino acids. This study investigated the amino acid composition of four multicomponent decoctions (with nine to twenty-eight different plants), focusing on their antioxidant potential and relevance to chronic disease prevention. The main objective was to analyze the amino acid profiles of selected decoctions to evaluate their contribution to oxidative stress reduction and their role as functional beverages. After an aqueous extraction with boiling water, decoctions were lyophilized before re-dissolution in water for derivatization using OPA/3-MPA and FMOC-Cl. Analysis was performed using high-performance liquid chromatography with fluorescence detection (HPLC-FLD). Antiradical activity, a reliable indicator of oxidative stress reduction, was evaluated using 2,2-diphenyl-1-picrylhydrazyl (DPPH•), 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid (ABTS•+) and nitric oxide radical (•NO) assays. The results revealed that all decoctions contain high levels of histidine (2.31 ± 0.18 μg/g to 5.75 ± 0.55 μg/g) and arginine (10.0 ± 0.7 μg/g to 32.5 ± 2.2 μg/g). Both amino acids are essential in free radical scavenging and oxidative stress reduction and in preventing chronic diseases such as cardiovascular disorders, diabetes, and obesity. A decoction with 28 components exhibited the highest activity against ABTS•+ and •NO, while the 14-component decoction showed the highest DPPH• scavenging capacity. Furthermore, two decoctions contained cysteine (0.99 ± 0.09 μg/g and 1.78 ± 0.83 μg/g), an important amino acid with potent antioxidant properties due to its ability to interact with redox reactions. Additionally, glutamine, a precursor for glutathione synthesis and essential for antioxidant defence, was present in all the samples. Multicomponent decoctions offer functional beverages with amino acid-driven antioxidants, supporting oxidative stress reduction and health promotion. They support sustainable food systems and serve as dietary strategies for chronic disease prevention and management, highlighting their potential in nutrition-based health interventions.

sciforum-114583: Antioxidant capacity of Colombian tropical fruits with dietary potential to reduce the risk of cardiovascular diseases

Claudia Milena Ardila Melendez

Nutrition and Dietetic Department, Faculty of health, Industrial University of Santander, ICU Hospital San Juan de Dios Floridablanca, Santander, Colombia, Floridablanca, Santander, 681003, Colombia

Colombian tropical fruits, such as carambolo (Averrhoa carambola L), mango (Mangifera indica), papaya (Carica papaya), pineapple (Ananas comosus), guayaba (Psidium guajava), golden berries (Physalis peruviana), lulo (Solanum quitoense), gulupa (Passiflora edulis Sims.), tamarillo (Cyphomandra betacea), curuba (Passiflora tripartida), tamarind (Tamarindus indica L.), avocado (Persea americana), and banana (Musa paradisiaca), are known for their high content of bioactive compounds. LDL oxidation is a leading cause of endothelial damage, and antioxidants can inhibit this process by donating hydrogen and capturing lipid radicals, thus protecting against cardiovascular diseases.

Objective

To review the phenolic compound content and antioxidant capacity of Colombian tropical fruits, measured by the DPPH and FRAP methods, it is important to assess their potential as dietary components for reducing the risk of cardiovascular diseases.

Methods

A bibliographic search was conducted in the Medline Elsevier and Scielo databases, including articles published in the last 12 years in English and Spanish.

Results

Phenolic compound content (mg eq of gallic acid/100 gr sample) is as follows: curuba: 638, avocado: 0.20-582.9, tamarillo: 92-300, lulo: 310, gulupa: 270, papaya: 240-263, golden berries: 59.2-265; carambolo: 143, guayaba: 199.21, mango: 217.6-652.6, banana: 302.58-1323.70, pineapple: 159.3-990.76, and tamarind: 10.82-20.23.

By measuring the oxidative capacity with the DPHH method (µmol Trolox/100 g sample), we attained the following results: carambolo: 429.55, gulupa: 366, golden berries: 243.6, tamarillo: 75, avocado: 165.10, lulo: 60, curuba: 55 , guayaba: 26.2, papaya: 14.62, mango: 23.7-174, tamarind: 293.93, pineapple: 34.80–36.45, and banana: 8.79. Meanwhile, using FRAP (µmol Trolox/g sample), we found the following results: carambolo: 7106.72, curuba: 148.1, gulupa: 464, golden berries: 345.2, papaya: 71.77, lulo: 52, tamarillo: 50, guayaba: 48.85, pineapple: 25.60–27.09, tamarind: 12.96, mango: 3.18, banana: 11.5, and avocado: 0.8.

FRAP and DPPH methods measure the antioxidant concentrations that could be used to reduce endothelial oxidative damage, due to the high antioxidant capacity to inhibit LDL oxidation, hydrogen donation, lipid radical capture, and metal ion chelation, and reduce the risk of developing cardiovascular diseases.

sciforum-115565: Computational Analysis of the Antioxidant Potential of Organic Compounds Using the Density Functional Theory Method

Loubenky Surfin [1,*], Rodrigo Gester [2] and Neidy Samara S. dos Santos [1]

[1] UNIVERSIDADE FEDERAL DO SUL E SUDESTE DO PARÁ (UNIFESSPA), PROGRAMA DE PÓS-GRADUAÇÃO EM QUÍMICA (PPGQ), MARABÁ /PA
[2] UNIVERSIDADE FEDERAL DO SUL E SUDESTE DO PARÁ (UNIFESSPA), PROGRAMA DE PÓS-GRADUAÇÃO EM QUÍMICA (PPGQ), MARABÁ/PA

This work presents a computational analysis of the antioxidant potential of organic molecular compounds using the DFT (Density Functional Theory) method, a technique that involves using advanced theoretical tools to predict and analyze the antioxidant activity of various organic molecules. This method also allows for the determination of key parameters influencing the antioxidant efficiency of compounds, such as ionization energy, electron affinity, and radical dissociation energy. These properties are essential for predicting the antioxidant behavior of molecules under various biological conditions and help identify which compound is most effective at capturing free radicals and thus preventing oxidative damage. We also demonstrate how these compounds can combat oxidative damage caused by free radicals in the body by using computational simulations and molecular modeling tools to assess the antioxidant potential of these molecular compounds. These compounds are crucial as they can prevent or repair damage caused by free radicals, a process that can lead to chronic diseases, cellular aging, and other serious health issues. In our research, we also studied the three main antioxidant mechanisms—HAT (Hydrogen Atom Transfer), SEP-PT (Sequential Proton Transfer), and SPLET (Single-Electron Transfer Proton Transfer)—in order to evaluate their effectiveness against free radicals. The results of this study highlight the significant impact of free radicals on our health and identify promising compounds for experimental testing, thus contributing to the development of new antioxidants with therapeutic, cosmetic, and nutritional applications. These findings also open new perspectives for future research and the potential application of computational methods in drug design and antioxidant development.

sciforum-111042: Dual Antioxidant and Antibacterial Activities of Natural Compounds: Evaluating Their Efficacy Against Pathogenic Bacteria

Hicham Wahnou [1,*], Fatimazahra Kadiri [1], Othman El Faqer [1], Zaynab Ouadghiri [1], Ismail Guenaou [2] and Youness Limami [3]

[1] Laboratory of Immunology and Biodiversity, Faculty of Sciences Ain Chock, Hassan II University, B.P 2693, Maarif, Casablanca, Morocco
[2] Laboratoire Santé Et Environnement, Faculté Des Sciences Ain Chock, Université Hassan II de Casablanca, B.P 5366 Maarif, Casablanca 20000, Morocco
[3] Laboratory of Health Sciences and Technologies, Higher Institute of Health Sciences,Hassan First University of Settat, Settat 26000, Morocco.

The rise of antibiotic-resistant bacteria presents a significant global health challenge, emphasizing the urgent need for alternative antimicrobial agents. This study investigates the antioxidant and antibacterial properties of several natural organic acids and flavonoids against common bacterial pathogens, including *Escherichia coli* (ATCC 25222), *Pseudomonas aeruginosa* (ATCC 27853), *Staphylococcus aureus* (ATCC 25923), *Salmonella enterica* (ATCC 13076), and *Bacillus subtilis* (ATCC 6633). To evaluate antibacterial activity, minimum inhibitory concentrations (MICs) and minimum bactericidal concentrations (MBCs) were determined through microdilution methods. Among the compounds tested, oxalic acid emerged as the most promising antibacterial agent, showing significant activity against *Bacillus subtilis* (MIC 0.087 μg/μl, MBC 0.35 μg/μl) and *Escherichia coli* (MIC 22.5 μg/μl, MBC 22.5 μg/μl). Additionally, oxalic acid exhibited potent antibacterial effects against *Staphylococcus aureus* (MIC 0.70 μg/μl, MBC 1.40 μg/μl) and *Salmonella enterica* (MIC 0.70 μg/μl, MBC 5.62 μg/μl). Succinic acid demonstrated moderate efficacy against *Pseudomonas aeruginosa* (MIC 0.18 μg/μl, MBC 0.73 μg/μl), while gallic acid proved particularly effective against *Salmonella enterica* (MIC 0.36 μg/μl, MBC 2.89 μg/μl). Other compounds tested, including quercetin, vanillin, ferulic acid, and ascorbic acid, showed varied antibacterial profiles.

In addition to antibacterial activity, the antioxidant properties of these compounds were evaluated, revealing a significant correlation between their antioxidant capacity and antimicrobial effects. This suggests that the antioxidant potential of these compounds may contribute to their antibacterial activity. Overall, the results highlight the potential of natural compounds as alternative antimicrobial agents, with a dual action as both antioxidants and bactericidal agents. These findings support the further exploration of natural products for developing new antimicrobial strategies to combat resistant bacterial infections.

sciforum-106705: Enhancement of cellular antioxidant enzyme system and tight junction integrity by plant sterol food supplement in co-culture model of intestinal inflammation

Mussa Makran [1,*], Ilenia Concetta Giardina [2], Guadalupe Garcia-Llatas [1], Alessandro Attanzio [2] and Antonio Cilla [1]

[1] Nutrition and Food Science Area, Faculty of Pharmacy and Food Sciences, University of Valencia. Av. Vicente Andrés Estellés s/n, 46100 Burjassot, Valencia, Spain
[2] Department of Biological, Chemical and Pharmaceutical Sciences and Technologies, University of Palermo, via Archirafi 28, 90123 Palermo, Italy

Introduction

A previous study showed that a plant sterol food supplement (PS-FS) improved markers of intestinal inflammation in a cell co-culture model [1]. However, it remains unclear whether these benefits stem from enhanced antioxidant defenses or improved tight junction (TJ) integrity.

Methods

This study investigates the effects of PS-FS (2 g PS/dose) on gene expression related to antioxidant defense and TJ proteins using a co-culture model of Caco-2 cells (apical) and RAW264.7 macrophages (basolateral). A bioaccessible fraction of PS-FS was obtained using simulated gastrointestinal digestion (INFOGEST 2.0) and applied to the apical chamber at a non-toxic dilution (1/20, v/v) for 90 min. Inflammation was induced later by adding lipopolysaccharides (1 µg/mL, 24 h) to the basolateral side. The interaction between the co-treatment of PS-FS and budesonide (1 µM/90 min) was examined. The gene expression of transcription factor Nrf2 (*NFE2L2*) and its target antioxidant enzymes (*GSTA1*, *NQO1*, and *HMOX-1*) was analyzed (qPCR) [2]. Additionally, the gene expression of TJ-related proteins like claudins (*CLDN1, CLDN3,* and *CLDN4*), occludin (*OCLN*), and zonula occludens-1 (*TJP1*) was assessed.

Results

PS-FS increased *GSTA1* (27%) and *HMOX-1* (124%) gene expression, indicating an activation of the Nrf2 pathway. It also upregulated the TJ proteins *CLDN3* (33%), *CLDN4* (212%), *OCLN* (57%), and *TJP1* (99%), suggesting a role in restoring the intestinal barrier. However, combining PS-FS with budesonide led to antagonistic effects.

Conclusions

PS-FS demonstrated potential in enhancing antioxidant responses and strengthening the intestinal barrier, suggesting that its incorporation into the diet may serve as a nutraceutical intervention for the management of inflammatory bowel disease.

Funding: This research is part of the project PID2019-104167RB-I00 funded by MCIN/AEI/10.13039/501100011033. Mussa Makran holds an FPU19/00156 grant from the Ministry of Sciences, Innovation and Universities (Spain).

References

[1] Faubel et al. (2024). *Food & Function*, 15, 6502-6511.
[2] Makran et al. (2023). *Food & Function*, *14*, 10829-10840.

sciforum-111572: New Therapeutic Perspectives: Olive Leaf Flavones and Their Synergy in Breast Cancer

María Losada-Echeberría *, Marta Fernández-Oliver, Paula de Juan-Maciá, Raúl Bonet-García, Vicente Micol and Enrique Barrajón-Catalán

Instituto de Investigación, Desarrollo e Innovación en Biotecnología Sanitaria de Elche (IDiBE), Universidad Miguel Hernández (UMH), 03202 Elche, España

Olive leaf extracts are rich in bioactive polyphenols, including secoiridoids, phenolic acids, and **flavonoids**, recognized for their anticancer potential. Among various cancers, **breast cancer** stands out as one of the most prevalent and lethal malignancies worldwide, with high morbidity and mortality rates. Despite advancements in treatment, including surgery, chemotherapy, hormone therapy, and targeted therapies, resistance to these interventions remains a significant challenge. As a result, there is a growing interest in plant-based compounds due to their potential to enhance the current therapies or provide novel, less toxic alternatives.

This study focuses on the **antiproliferative effects of three flavonoids** from olive leaves due to their well-documented antioxidant, anti-inflammatory, and anticancer properties. We aimed to determine how their combinations, at various ratios, influence the **inhibition of breast cancer cell growth**.

Using **CompuSyn** software, we modeled their synergistic, additive, and antagonistic effects based on the **Combination Index** values. Various ratios of the three flavonoids were tested through **MTT viability assays** on the **MCF-7** (estrogen-receptor-positive) and **JIMT-1** (HER2-positive, trastuzumab-resistant) breast cancer cell lines. Additionally, an **3D isobologram** was generated to visualize and confirm the nature of these interactions. The results revealed that the type of interaction depends significantly on the flavonoid ratios.

The **natural ratio** in olive leaf extract demonstrated **strong synergy**, enhancing its antiproliferative activity and confirming prior research on its efficacy against breast cancer. The o**ptimized flavonoid ratios** showed even greater synergy, suggesting that tailored combinations could surpass the previously reported results and offer a new avenue for more potent, plant-based cancer therapies.

These findings underscore the importance of **refining the flavonoid ratios** and exploring their molecular mechanisms to **enhance polyphenol-based treatments**. Further research could lead to novel therapeutic formulations that provide more **effective and targeted alternatives** to the conventional treatments, improving patient outcomes while reducing side effects.

sciforum-113932: Polyphenols as Modulators of Fibrinogen-Driven Neuroinflammation: Implications for Neurodegenerative Disease Prevention

Federica Carnemolla *, Manuela Leri, Serena Borghi, Flavia Rita Argento, Elvira Giurranna, Francesca Nencini, Claudia Fiorillo, Niccolò Taddei, Matteo Becatti and Monica Bucciantini

Department of Experimental and Clinical Biomedical Sciences "Mario Serio", University of Florence, Viale Morgagni 50, 50134 Florence, Italy

Polyphenols are natural compounds found in a variety of plants and are widely recognized for their antioxidant properties and potential health benefits, particularly in relation to inflammation and neuroprotection. Among these, oleuropein aglycone (OleA) and its main metabolite hydroxytyrosol (HT) from extra virgin olive oil (EVOO) and olives have the potential to counteract pro-inflammatory signals in the brain, including those triggered by fibrinogen, a key protein involved in blood clotting. Fibrinogen is known to activate microglia, the resident immune cells of the central nervous system, leading to the production of inflammatory cytokines that exacerbate neuroinflammatory conditions.

The aim of our study was to enhance the understanding of the molecular mechanisms underlying the protective effects of EVOO polyphenols at different concentrations on fibrinogen-induced damage by conducting in vitro experiments using the human microglia C13NJ and SH-SY5Y neuronal cell models, where cellular viability and oxidative stress were assessed. Additionally, immunofluorescence analysis was performed to measure the levels of neuroinflammatory markers, and we investigated the mitochondrial efficiency in microglia and neuronal cells treated with C13NJ-conditioned medium.

Our results indicate that both OleA and HT prevent the activation of TRL4 and p-NF-κB and the release of pro-inflammatory chemokines and cytokines, as evidenced by conditioned medium treatments on SH-SY5Y cells. Moreover, OleA and HT promote an increase in TREM2 levels and act as epigenetic modulators on histone 4 lactylation while also increasing the mitochondrial function.

The ability of OleA and HT to promote an anti-inflammatory microglial phenotype positions them as promising molecules for reducing neuroinflammation, protecting neurons from damage, and supporting overall brain health. Dietary or supplemental strategies incorporating these polyphenols could provide preventive approaches and strategies aimed at mitigating inflammation before the onset of neurodegenerative diseases. Additionally, they may serve as complementary therapies to existing treatments that focus on managing neuroinflammation and supporting neuronal health.

sciforum-111884: The incorporation of antioxidants to prevent and treat chronic diseases: understanding their effects from a nutrigenomic perspective

A. Perez-Vazquez [1,*], P. Barciela [1], M. Carpena [1], A. G. Pereira [2,3], A.O.S Jorge [4,5], Ezgi Nur Yuksek [4] and M.A. Prieto [1,3]

[1] Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Faculty of Science, E32004 Ourense, Spain.
[2] Nutrition and Bromatology Group, Department of Analytical and Food Chemistry, Faculty of Food Science and Technology, Universidade de Vigo, Ourense Campus, E32004 Ourense, Spain.
[3] Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolo-nia, 5300-253 Bragança, Portugal.
[4] Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, España.
[5] LAQV@REQUIMTE, Department of Chemical Sciences, Faculdade de Farmácia, Universidade do Porto, R. Jorge Viterbo Ferreira 228, 4050-313, Porto, Portugal.

In contemporary society, one of the most pressing concerns is the prevention and treatment of chronic diseases (CDs). CDs are non-communicable diseases with persistent effects; they include cardiovascular diseases (CVDs), neurodegenerative diseases, cancer, and diabetes, among others. Despite their high prevalence, epidemiological studies indicate that 30% of cancers, 80% of cardiovascular diseases, and 90% of type 2 diabetes could be avoided by diet and lifestyle changes. Furthermore, several studies have shown the strong association between an excess of oxidative stress, driven by reactive oxygen species (ROS) and reactive nitrogen species (RNS), and the pathogenesis of CDs. Prolonged exposure to elevated levels of pro-oxidant factors has been linked to functional impairments in enzymes and cellular structures, which in turn lead to aberrant gene expression. Consequently, the integration of antioxidant compounds into the diet has been proposed as a preventive strategy to mitigate oxidative stress and thereby reduce the incidence of CDs. For instance, resveratrol, found in red grapes and berries, activates the *SIRT1* gene, improving mitochondrial function and reducing oxidative damage, which helps prevent atherosclerosis and lowers CVD risk. Similarly, epigallocatechin gallates (EGCG) in green tea reduce oxidative stress and inflammation in adipose tissue by modulating the *UCP1* gene, promoting thermogenesis and preventing obesity-related complications. Therefore, implementing dietary interventions is expected to reverse the oxidative imbalance that favors the development of these diseases by combining a preventive dietary approach with therapeutic intervention. In this sense, nutrigenomics aims to serve as a key tool by determining the influence of diet on gene expression and, in particular, by identifying how the intake of antioxidant compounds can modify the oxidative stress produced. This review aims to provide a general vision on the role of antioxidants in the prevention of chronic diseases, incorporating nutrigenomics as a valuable tool.

sciforum-111728: Total Phenolic and Flavonoid Contents, Antioxidant and Anti-Inflammatory Activities of Different Solvent Fractions from the Ethanolic Extract of *Allium ampeloprasum* ("Sibujing")

Joshua Abelgas and Nesteve John Agosto *

[1] Department of Chemistry, University of Science and Technology of Southern Philippines, Cagayan de Oro City, 9000, Philippines
[2] Center for Natural Products Research, University of Science and Technology of Southern Philippines, Cagayan de Oro City, 9000, Philippines

The spice *Allium ampeloprasum*, commonly known as "sibujing," is a key ingredient in the "palapa" condiment, popular in Maranao dishes, and is traditionally used by the Maranao people in the Lanao regions of Mindanao, Philippines, to treat inflammatory diseases, fever, and cough. This study investigates the total phenolic content (TPC), total flavonoid content (TFC), and the antioxidant and anti-inflammatory activities of the crude ethanolic extract of *A. ampeloprasum* and its solvent fractions. TPC was determined using the Folin–Ciocalteu method, while TFC was assessed using the aluminum chloride colorimetric method. Anti-inflammatory activity and antioxidant activity were measured using the egg albumin denaturation assay and the DPPH radical scavenging assay, respectively. The results showed that the ethyl acetate fraction had the highest TPC (68.54 ± 1.44 mg GAE/g) and a moderately strong antioxidant capacity (EC_{50} = 221.40 ± 2.97 μg/mL). On the other hand, the hexane fraction had the highest TFC (169.88 ± 0.64 mg QE/g) and showed promising anti-inflammatory activity (IC_{50} = 205.83 ± 6.73 μg/mL). Interestingly, a very strong inverse correlation was observed between TPC and antioxidant EC_{50}, while a moderate inverse correlation was noted between the TFC and anti-inflammatory IC_{50} of the plant's extract and fractions. These correlations suggest that the phenolic and flavonoid compounds in the plant's extract and fractions may significantly contribute to *A. ampeloprasum*'s antioxidant and anti-inflammatory effects. These findings support the traditional medicinal use of *A. ampeloprasum* for treating inflammatory diseases, highlight its natural antioxidant properties, and underscore its potential as a valuable source of bioactive compounds. This study recommends further research to identify the specific active compounds responsible for the observed biological activities.

sciforum-113752: Undertaking a Literature Review: Quercetin, A Flavonoid with Therapeutic Promise in Chronic Illness

Dr. Shweta Keswani *, Dr. Dipali Saxena and Manisha Trivedi

Food and Nutrition, Shri Vaishnav Institute of Home Science, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore MP

Quercetin is a plant-derived flavonoid found in various fruits, vegetables, and beverages, and it is known for its potent antioxidant, anti-inflammatory, and immune-modulating properties. Its role in managing chronic diseases has been widely studied, showing promise in several areas. Quercetin and quercetin-rich foods have been reported to have a wide range of health-promoting effects, especially in the prevention and management of several diseases; however, its solubility and bioavailability have limited its use. It is beneficial in diseases with an inflammatory component, such as rheumatoid arthritis, inflammatory bowel disease (IBD), and asthma, inhibiting the inflammatory pathways by suppressing pro-inflammatory cytokines (e.g., TNF-α, IL-6) and enzymes (e.g., COX-2). It prevents or reduces oxidative stress-linked conditions like cardiovascular diseases (CVDs), neurodegenerative disorders (e.g., Alzheimer's), and diabetes, as Quercetin neutralizes free radicals and upregulates antioxidant defenses (e.g., glutathione). It has a potential role in managing hypertension, atherosclerosis, and heart disease as it improves endothelial function, reduces blood pressure, and lowers LDL cholesterol by enhancing nitric oxide bioavailability and reducing lipid peroxidation. It is a proven fact that the consumption of Quercetin improves insulin sensitivity, lowers blood glucose levels, reduces complications by modulating glucose transporters, inhibits α-glucosidase enzymes, and protects pancreatic β-cells from oxidative damage. Due to its multifunctional biological effects, Quercetin holds significant potential in managing chronic diseases. While it is not a substitute for standard medical treatments, it can be an effective complementary approach under professional guidance. This review explores the current literature surrounding quercetin's versatile properties, mechanisms of action, and its role in the prevention and treatment of conditions such as cardiovascular diseases, diabetes, cancer, and other diseases.

Session 4. Antioxidants Intake and Gut Microbiome

sciforum-110489: Bioactive Potential of Chardonnay White Wines: Evaluation of Phenolic Compounds and Antioxidant Capacity Before and After In Vitro Digestion

José Ricardo Machado dos santos * and Aniela Pinto Kempka

Santa Catarina State University. Department of Food Engineering and Chemical Engineering, Graduate Program in Food Science and Technology. Pinhalzinho – SC, Brazil

The increase in white wine sales and the scarcity of studies on their bioactive potential compared to red wines motivated this study, which aimed to evaluate the total phenolic compounds (TPCs) and total antioxidant capacity (TAC) in five *Chardonnay* white wines, both before and after in vitro gastrointestinal digestion, as well as to analyze the bioaccessibility (BA%) of TPCs. Phenolic compounds were determined using HPLC; TPCs (mg GAE/L) were quantified by the Folin–Ciocalteu method; and TAC (µM Trolox equivalent) was measured through the reduction of Cu^{2+} to Cu^{+}. The in vitro digestion process included a gastric phase with pepsin (pH 1.3, 37°C, 1 hour), followed by an intestinal phase with pancreatin (pH 6.7, 37°C, 2 hours). The TPC concentrations varied as follows: Wine 1, from 290.9 ± 0.63 mg GAE/L to 119.4 ± 11.32 mg GAE/L (BA% 41.04%), with TAC decreasing from 2720 ± 47.02 µM to 1343.3 ± 55.89 µM; Wine 2, from 156.0 ± 11.68 mg GAE/L to 109.5 ± 6.85 mg GAE/L (BA% 70.19%), with TAC decreasing from 1753.8 ± 58.90 µM to 730.55 ± 228.72 µM; Wine 3, from 296.9 ± 14.03 mg GAE/L to 214.2 ± 37.45 mg GAE/L (BA% 72.14%), with TAC decreasing from 2586.66 ± 56.59 µM to 1229.44 ± 121.03 µM; Wine 4, from 184.5 ± 31.35 mg GAE/L to 144.5 ± 19.42 mg GAE/L (BA% 78.31%), with TAC decreasing from 2560 ± 23.51 µM to 958.55 ± 37.44 µM; and Wine 5, from 344.6 ± 43.69 mg GAE/L to 217.6 ± 18.09 mg GAE/L (BA% 63.14%), with TAC decreasing from 2985.55 ± 59.16 µM to 1647.22 ± 158.34 µM. The most prominent phenolic compounds identified were epicatechin and quercetin-3-rhamnoside. In summary, TAC decreased after digestion but remained at significant levels, as did BA%, suggesting that white wines may contribute to the intake of bioactive compounds with antioxidant potential. These findings emphasize the need for further investigation into the interaction between bioactive compounds from natural sources, such as white wine, and their role in modulating antioxidant enzyme systems, taking into account the biochemical transformations of phenolic compounds during gastrointestinal digestion and their effects on the human body.

sciforum-106572: Influence of probiotics on gut microbiota and their systemic antioxidant capacity: a narrative review

Michele Antonelli [1,*] and Davide Donelli [2]

[1] Private Practice for Evidence-Based Integrative and Preventive Medicine, Cavriago, Italy.
[2] Cardiology Unit, University Hospital of Parma (Italy)

Background

Probiotics, live microorganisms known for their gut health benefits, are increasingly recognized for their potential to enhance antioxidant capacity and reduce oxidative stress and inflammation. This is particularly important in inflammaging, digestive problems, cardiometabolic conditions, and neurodegenerative diseases, where oxidative stress and gut dysbiosis are common. Compared to direct antioxidant supplementation, probiotics may offer more comprehensive benefits by simultaneously modulating the gut microbiota and promoting endogenous antioxidant defenses.

Objective

This narrative review explores how probiotics influence antioxidant capacity and the gut microbiota, emphasizing their potential advantages over traditional antioxidant supplements.

Methods

A review of the existing literature on the effects of probiotics on the gut microbiota, antioxidant biomarkers, and related health outcomes was conducted.

Results

Probiotic supplementation consistently increased endogenous antioxidant enzymes, including catalase (CAT), glutathione peroxidase (GSH-Px), superoxide dismutase (SOD), and total antioxidant capacity (T-AOC). It also decreased oxidative stress markers such as malondialdehyde (MDA) and hydrogen peroxide (H_2O_2). Unlike direct antioxidants, probiotics act through multiple pathways: modulating the gut microbiota, enhancing the gut barrier, and stimulating the immune system. These effects were particularly notable in patients with disease-related oxidative stress. While all probiotics contribute to antioxidant capacity and gut health, **Lactobacillus rhamnosus**, **Lactobacillus casei**, and **Bifidobacterium longum** stand out for their pronounced effects on reducing oxidative stress and improving gut-related conditions. Their targeted actions make them ideal candidates for managing chronic diseases associated with inflammation and oxidative damage.

Conclusions

Probiotics provide significant antioxidant benefits while restoring gut microbiota balance. This integrative approach makes probiotics potentially more effective than traditional antioxidants, particularly for patients with diseases characterized by oxidative stress and inflammation.

sciforum-113723: Interplay of Gut Microbiota and Neurodegeneration

Mamatha Bhanu L S

Department of Biotechnology, Yuvaraja's College, University of Mysore, Mysore-570006, India

The study of the gut microbiota's impact on brain functions has revealed a significant correlation, with the dysregulation of the gut–brain axis being linked to neurological disorders. The gut microbiota and brain communicate via four main routes, with the vagus nerve being the most crucial mode connecting the GI tract to the brain stem. Recent studies reveal that enteric pathogens and probiotics can influence host behaviors like anxiety, feeding, and depression by altering GABA, oxytocin, and BDNF signaling in the brain. Certain gut bacteria metabolites are linked to an increase in reactive oxygen species levels, a significant risk factor for neurodegeneration. Gut bacteria metabolites not only contribute to the development of life-threatening brain disorders but also play a crucial role in their prevention. Recent studies highlight two crucial connections between the gut microbiota and the brain: "gut microbiota–oxidative stress–neurodegeneration" and "gut microbiota–antioxidant–neuroprotection." This review provides a comprehensive overview of studies examining gut microbiota-mediated oxidative stress in neurodegeneration and the microbiota's role in neuroprotection. Traumatic Brain Injury (TBI), a prevalent injury with an annual incidence of around 1.4 million in the US, is a major cause of death and disability worldwide. TBI disabilities involve primary brain damage, secondary cellular and molecular damage, and metabolic anomalies, leading to temporary or lifelong cognitive impairments. TBI, a heterogeneous pathobiological condition, presents with multiorgan damage and lacks therapies due to its heterogeneous nature, necessitating the consideration of novel therapeutic regimens. Gut eubiotic therapeutics have gained significant attention due to their ability to restore the bifacial relationship between gut dysbiosis and type 2 diabetes. The detection of gut microbiota modulation could serve as a diagnostic tool for identifying TBI severity, thereby enabling the development of targeted therapeutic approaches.

sciforum-114085: Prebiotic Activity of Polyphenols in Modulating Gut Microbiota

Daniele Giuseppe Buccato [1], Lorenza Francesca De Lellis [1], Adriana Delgado-Osorio [2,3], Maria Vittoria Morone [4], Hammad Ullah [1], Alessandro Di Minno [1,5], José Ángel Rufián Henares [2,3] and Maria Daglia [1,*]

[1] Department of Pharmacy, University of Napoli Federico II, Via D. Montesano 49, 80131 Naples, Italy
[2] Department of Nutrition and Food Science, Institute of Nutrition and Food Technology, Biomedical, Research Centre, University of Granada, Granada, Spain;
[3] Instituto de Investigación Biosanitaria ibs. GRANADA, Universidad de Granada, Granada, Spain;
[4] Department of Experimental Medicine, Section of Microbiology and Clinical Microbiology, University of Campania "L. Vanvitelli", 80138 Naples, Italy
[5] CEINGE-Advanced Biotechnologies, Via Gaetano Salvatore 486, 80145 Naples, Italy

Introduction

Polyphenols, secondary metabolites synthesized by plants, are well known for their bioactive properties, including antioxidant, anti-inflammatory, and antimicrobial activities. Recently, their ability to modulate gut microbiota composition and functionality has gained increasing attention due to their potential impact on health and disease. The gut microbiota, critical for maintaining both intestinal and systemic health, can shift from eubiosis to dysbiosis, contributing to various diseases, such as metabolic disorders and chronic inflammation. In this context, plant-derived polyphenols offer promising interventions for restoring microbial balance and enhancing gut health.

Methods

This study investigated the modulatory effects of polyphenols from two sources, propolis, and pomegranate, on gut microbiota composition and functionality through *in vitro* digestion and fermentation processes in both healthy and diseased conditions. Short-chain fatty acid (SCFA) profiles were quantified using chromatographic methods, and for propolis extract, changes in gut microbiota composition were assessed through 16S rRNA amplicon high-throughput sequencing (HTS).

Results

The fermentation process demonstrated that pomegranate modulates gut microbiota functionality by significantly increasing SCFA production, mainly lactic acid, an essential precursor for their synthesis. Meanwhile, a standardized polyphenol mixture extracted from poplar-type propolis enhanced SCFA levels, including acetate, propionate, and butyrate. Propolis also promoted the growth of key SCFA-producing bacterial genera, such as *Roseburia*, *Faecalibacterium*, and *Bifidobacterium*.

Conclusions

Both propolis and pomegranate exhibit distinct abilities to modulate gut microbiota composition and activity, highlighting their potential as prebiotic ingredients. These findings underscore the relevance of polyphenols in preventing and managing dysbiosis-related diseases, offering new insights for the development of functional foods and nutraceuticals.

sciforum-113741: Preserving Heritage, Promoting Health: A Review of Antioxidants in Indian Women's Nutrition

Manisha Trivedi [1,*], Dipali Saxena [2] and Shweta Keswani [2]

[1] Research Scholar, Department of Foods and Nutrition, Shri Vaishnav Institute of Home Science, Shri Vaishnav Vidyapeeth Vishwavidyalaya Indore, Madhya Pradesh, India
[2] Assistant Professor, Department of Foods and Nutrition, Shri Vaishnav Institute of Home Science, Shri Vaishnav Vidyapeeth Vishwavidyalaya Indore, Madhya Pradesh, India

The traditional Indian diet, rich in spices, fruits, vegetables, legumes, and whole grains, offers a unique repository of antioxidants that contribute significantly to overall health and well-being. Antioxidants, such as polyphenols, flavonoids, and carotenoids, are known to neutralize oxidative stress, reduce inflammation, and support gut microbiome diversity. For Indian women, whose dietary practices are shaped by cultural traditions, regional cuisines, and socio-economic factors, antioxidant-rich diets play a crucial role in mitigating lifestyle-related diseases and promoting long-term health. This review explores the key sources of antioxidants in traditional Indian diets, including turmeric, ginger, amla, fenugreek, green leafy vegetables, and seasonal fruits, highlighting their biochemical properties and synergistic effects on gut microbiota. The role of these bioactive compounds in fostering beneficial microbes like Lactobacillus and Bifidobacterium, reducing pathogenic strains, and supporting metabolic and immune health is emphasized. Despite the nutritional richness of traditional diets, urbanization, lifestyle shifts, and the increasing consumption of processed foods have altered dietary patterns among Indian women, leading to reduced antioxidant intake and the rising prevalence of chronic diseases such as diabetes, cardiovascular disorders, and obesity. This review identifies challenges in preserving traditional dietary practices, including limited awareness, changing food habits, and accessibility issues. Additionally, this study underscores the importance of integrating traditional dietary wisdom with contemporary nutritional science. Furthermore, gaps in research on bioavailability, regional variations, and long-term health impacts of antioxidants are highlighted, advocating for more targeted studies. This review concludes that preserving India's culinary heritage is critical for promoting women's health and offers insights into leveraging traditional diets as a sustainable approach to improving public health outcomes.

sciforum-107240: Synbiotics as antioxidants in Multiple Sclerosis through gut-brain axis modulation.

Dan Sebastian Nica [1,*], Carmen Valeria Albu [2], Carmen Nicoleta Oancea [3], Alina Boengiu [1] and Ana Maria Buga [3]

[1] Doctoral School, University of Medicine and Pharmacy of Craiova, Romania
[2] Neurology Department, University of Medicine and Pharmacy of Craiova, Romania, Neuro-Psichiatry Hospital
[3] Biochemistry Department/University of Medicine and Pharmacy of Craiova, Romania

Gut microbiota and human health are in a symbiotic relation ship and work together to mentain the healthy state. Since the gut microbiota display key immunological and anti oxidative tasks, the altered gut microbiota balance can lead to the development of sistemic inflammation and accelerate the multiple Sclerosis (MS) progression. Some gut bacteria population produce reactive oxygen species (ROS). When these type of bacteria are increased the pro and anti oxidative unbalance appear that alter gut epithelial barrier and trigger systemic inflammation, acting fair away from gut (at brain level) throught gut inflammatory and pro-oxidative signals. Growing evidence show that targeting gut microbiota can be a promising strategy for the MS diseases management. Our hypothesis is that anti oxidant compounds that add multi species beneficial bacteria and promote "good" bacteria growth by fibre substitutes (inulin) decrease ROS production. MS patients (n=25) that received multi species bacteria and inulin and 15 MS patients without supplements were included in this pilot studies. Biomarkers of oxidative stress (e.g protein carbonyl, lipids per oxidation) and anti oxidative response (e.g GSH, SOD, CAT) together with inflammatory biomarkers and intestinal barrier biomarkers (e.g zonulin) was measured in both group. All these biomarker was correlated with MS diseases status and progression using valid scales such as EDSS scale. Results: we showed a reduction of pro-inflammatory cytokines, an improvement of mitochondrial disfunction and decrease in ROS production by multi species bacteria supplements in combination with fibre substitutes such as inulin. These compounds enhance the action of standard therapy in MS people, positively impacting the diseases status and MS progression.

Session 5. Natural and Synthetic Antioxidants and Antioxidant Enzyme Systems

sciforum-111298: Achillea clypeolata: extraction, phenolic profile, cytotoxic and antioxidant activities, and pro-angiogenic potential in human keratinocytes

Dragana Dekanski [1], Aleksandra A. Jovanović [2], Mirjana Marčetić [3], Mirjana Nacka-Aleksić [2], Aleksandra Vilotić [2], Žanka Bojić-Trbojević [2], Sanja Vlaisavljević Krstić [4], Milica Jovanović Krivokuća [2] and Andrea Pirković [2,*]

[1] University of Belgrade, Institute for the Application of Nuclear Energy - INEP
[2] Institute for the Application of Nuclear Energy INEP, University of Belgrade, Banatska 31b, 11080 Belgrade, Serbia
[3] Faculty of Pharmacy, University of Belgrade, Vojvode Stepe 450, 11221 Belgrade, Serbia
[4] Institute of Pharmaceutical Sciences, University of Graz, Beethovenstraße 8, 8010 Graz, Austria

Species of the genus *Achillea* L. (Asteraceae) are recognized as valuable sources of natural antioxidants and are widely used for their diverse pharmacological properties. This study aimed to examine the phenolic composition of the methanolic extract of the aerial parts of yarrow, *Achillea clypeolata* (ACE), as well as its cytotoxicity, antioxidant effects, and the potential molecular mechanisms involved in angiogenesis, which plays a crucial role in wound healing. The extract's composition was analyzed using the HPLC method. Total polyphenol content (TPC) of 116.69±8.18 mg GAE (gallic acid equivalent)/g dry extract was determined viathe Folin–Ciocalteu assay. Antioxidant activity was assessed spectrophotometrically, showing 38.68±2.29 μmol Trolox equivalents pergram of dry extract based on the ABTS radical inhibition and an IC_{50} (concentration required to neutralize 50% of free radicals) value of 685.6±9.8 μg/mL for DPPH• radical scavenging. Cytotoxicity was evaluated in HaCaT human keratinocyte cells over a concentration range of 1 to 200 μg/mL, identifying concentrations below 50 μg/mL as non-cytotoxic. The production of intracellular reactive oxygen species (ROS) in HaCaT cells exposed to the extract with or without hydrogen peroxide treatment was measured using the H2DCFDA assay. The results demonstrated that ACE is rich in flavonoids and phenolic acids with significant in vitro antioxidant potential. It also effectively reduced ROS levels in HaCaT cells. The impact of ACE on pro-angiogenic factors (VEGFA, HiF1α, and MIF) was evaluated at the protein level using cell-based ELISA, and it was shown that ACE at 25 μg/mL significantly enhanced the expression of all examined factors. These findings suggest that ACE is a promising bioactive compound with potential uses in the pharmaceutical and cosmetic industries, as well as in the creation of scaffolds that encourage angiogenesis and wound healing.

sciforum-112308: Antioxidant Effect of Pinene in Biological Systems

Jose Lucas de Oliveira Sousa [1,*], Gardenia Sampaio Moreira [2], Ayron Antônio Figueirêdo Leite [1], Andreza Guedes Barbosa Ramos [2] and Sávio Benvindo Ferreira [3]

[1] Nursing Academic Unit (UAENF), Teacher Training Center (CFP), Federal University of Campina Grande (UFCG), Cajazeiras, PB, Brazil
[2] Academic Unit of Life Sciences (UACV), Teacher Training Center (CFP), Federal University of Campina Grande (UFCG), Cajazeiras, PB, Brazil
[3] Academic University of Life Sciences, Teacher Training Center, Federal University of Campina Grande, Cajazeiras campus, Rua Sérgio Moreira de Figueiredo, Populares, 58900-000, Cajazeiras, Paraíba, Brazil.

Introduction

Pinenes, compounds from the monoterpene class, stand out for their bioactive properties, such as their antioxidant, anti-inflammatory, and antimicrobial effects. Oxidative stress, associated with various chronic diseases, has increased the demand for natural antioxidants like pinenes, which are widely used in the pharmaceutical and cosmetic industries.

Objective

We wished to investigate the antioxidant potential of pinenes.

Method

This was a literature review on the antioxidant potential of pinenes. The article selection was conducted between October and November 2024 through searches in the Scielo, PubMed, and CAPES journal databases using the descriptors and the Boolean operators “pinene” AND “antioxidant.”

Results and Discussion

Research has shown that pinenes, such as alpha-pinene and beta-pinene, have significant antioxidant effects. Studies demonstrate that these compounds increase the activity of antioxidant enzymes, such as superoxide dismutase (SOD) and catalase (CAT), and reduce markers of oxidative stress, such as malondialdehyde (MDA) and reactive oxygen species (ROS). Alpha-pinene protects against carbon-tetrachloride-induced cardiac lesions in rats by modulating oxidative stress and inflammation. Beta-pinene has shown potential in reducing the oxidative stress caused by arsenic in rice plants, promoting the recovery of natural antioxidant defenses. Pinenes, especially alpha- and beta-pinene, demonstrate great potential as antioxidants, with the ability to reduce oxidative stress and modulate inflammatory processes.

Conclusions

These results suggest that pinenes have therapeutic potential in diseases related to oxidative stress, such as neurodegenerative and inflammatory diseases, standing out as promising candidates for the development of treatments and products in the pharmaceutical and cosmetic industries. However, most of these studies have been conducted in animal or plant models, highlighting the need for human research to confirm these benefits.

sciforum-114090: Role of a Natural Preservative in the Secondary Shelf-life of Ready-to-Use Meat Pâté

Beatrice Sordini *, Sonia Esposto, Arianna Bonucci, Ilenia Dottori, Luigi Daidone, Stefania Urbani, Gianluca Veneziani, Roberto Selvaggini, Maurizio Servili, Davide Nucciarelli and Agnese Taticchi

Department of Agricultural, Food and Environmental Sciences, University of Perugia, Italy

By-products from the agro-food industry can serve as innovative sources of natural ingredients in the reformulation of traditional foods, enhancing their overall quality, extending secondary shelf-life (SSL), and mitigating food loss and waste. This study aims to evaluate the effect of the addition in a ready-to-use meat pâté of an olive vegetation water phenolic extract (OWVE) at two concentrations (250 mg of phenols per kg of product (MP1) and 500 mg of phenols per kg of product (MP2)). Physicochemical and sensory properties and the antioxidant activity of OWVE-added pâté samples were evaluated and compared with a control sample (CTRL; without antioxidants), simulating the retail storage conditions typical for products sold loose in deli counters. The evolution of key quality parameters was monitored during the SSL at various intervals: 0, 1, 2, 3, 4, 7, 8, 9, 10, and 11 days after the packaging was opened. The addition of OWVE effectively reduced the formation of primary and secondary oxidation products, thereby enhancing the oxidative stability of the lipid fraction. The formation and accumulation of aldehydes C6–C9, which are responsible for the "rancid off-flavour", were significantly minimised in the OWVE-added pâté samples in a dose-dependent way. Additionally, the OWVE-added samples demonstrated significantly higher antioxidant activity and α-tocopherol content compared to the CTRL at every assessed time point. No sensory defects were detected in any of the samples; however, a more pronounced olive flavour was noted in the MP2 samples compared to MP1 and CTRL. The findings of this study suggest that OWVE could serve as a promising natural preservative for food formulations with complex compositions. This highlights its potential usefulness in countertop gastronomy products, allowing for the extension of SSL without the need for synthetic additives. This approach offers a sustainable solution for reducing food loss and waste in marketing and home preservation practices.

sciforum-111791: Activation of ARE/Nrf2 and inhibition of NFkB are involved in the protective effect of phytonutrients and estradiol in human skin cells under mitochondria-generated oxidative stress

Aya Hisham Darawsha * and Yoav Sharoni

Ben-Gurion University of the Negev, Beer-sheva, Israel

During cell aging, mitochondrial ROS (mtROS) cause mitochondrial DNA mutations, which lead to mitochondrial dysfunction. This causes an increased production of mtROS, creating a vicious cycle and leading to accelerated aging. We used rotenone, a complex I inhibitor, to cause mitochondrial dysfunction in dermal fibroblasts, which resulted in high mitochondrial and cytosolic ROS levels, apoptotic cell death, increased matrix metalloproteinase-1 secretion, and decreased collagen secretion. Pre-treatment with carotenoid-rich tomato extracts, rosemary extract, and estradiol reversed these effects. The aim of the current study was to evaluate the effect of rotenone and phytonutrients and estradiol on mitochondrial respiration and cell senescence and to analyze the mechanisms involved in these effects. Rotenone caused a substantial reduction in mitochondrial respiration and ATP levels and increased the number of senescent cells. These effects were reversed by phytonutrients and estradiol. The enhanced mitochondrial respiration as a result of the phytonutrient and estradiol treatment was associated with increased mitochondrial biogenesis. Rotenone treatment was associated with an increased activity of NFκB and AP-1 transcription systems, whereas the phytonutrients and estradiol caused an inhibition of these activities and an activation of antioxidant response element (ARE/Nrf2) transcriptional activity. To determine whether the activation of ARE/Nrf2 and inhibition of NFκB are crucial for cell protection, we inhibited these pathways by the Nrf2 inhibitors ML385 and ochratoxin A and by the NFκB inhibitors IKK-16 and JSH-23. Inhibition of ARE/Nrf2 markedly reduced the protective effects of the phytonutrients and estradiol by diminishing their potential to reduce mtROS and the ATP level. Inhibition of NFκB markedly reduced rotenone-induced cell damage, similar to the effects of the phytonutrients and estradiol, suggesting that NFkB inhibition is important for skin cell protection. The presented results indicate that tomato carotenoids, rosemary extract, and estradiol protect dermal fibroblasts from damage caused by mtROS and may thus delay skin cell senescence and improve skin health.

sciforum-111280: Aging-related oxidative stress impairs structural/functional properties and cell signaling in human red blood cells—unveiling the protective role of Açaì Berry.

Alessia Remigante [1,*], Sara Spinelli [2], Angela Marino [2] and Rossana Morabito [2]

[1] University of Messina, Department of Chemical, Biological, Pharmaceutical and Environmental Sciences
[2] Department of Chemical, Biological, Pharmaceutical and Environmental Sciences University of Messina, Messina (Italy)

Aging is a process characterized by a general decline in physiological functions. The high bioavailability of reactive oxygen species (ROS) plays an important role in the aging rate. Red blood cell deformability is the ability of cells to modulate their shape to ensure transit through narrow capillaries of the microcirculation. A loss of deformability can occur in several pathological conditions, during natural aging through an increase in membrane protein phosphorylation, and/or through the structural rearrangements of cytoskeletal proteins due to oxidative conditions, with a key role played by band 3. Due to the close relationship between aging and oxidative stress (OS), functional foods rich in flavonoids are excellent candidates to counteract age-related changes. This study aimed to verify the protective role of Açaì extract in a D-Galactose (D-Gal)-induced model of aging in human red blood cells. Our results showed that Açaì berry extract (10 μg/mL) avoided the formation of leptocytes, prevented the increased OS, and restored alterations in the distribution of band 3 protein (B3p) and CD47 proteins in red blood cells exposed to 100 mM D-Gal. Moreover, the significant decrease in membrane red blood cell deformability associated with D-Gal treatment was alleviated by pre-treatment with Açaì extract. The extract completely restored the increase in B3p phosphorylation and Syk kinase levels, but this effect was only partial for the alterations in the distribution of spectrin, ankyrin, and protein 4.1 after exposure to 100 mM D-Gal treatment. Interestingly, D-Gal exposure was also associated with an acceleration of the rate constant of SO_4^{2-} uptake through B3p, as well as A1c formation. Both alterations were attenuated by pre-treatment with the Açaì extract. These findings contribute to clarifying the aging mechanisms in human red blood cells and to proposing flavonoid-rich functional foods as natural antioxidants for the treatment and prevention of OS-related disease conditions.

sciforum-110446: Antioxidant activity and pharmacokinetic profiling of *Urtica dioica* extract: potential therapeutic applications

Ahlem Ben chira [1,2,*], Yassine Kadmi [2] and Riadh Badraoui [3]

[1] Laboratoire d'Ecophysiologie Animale, Faculté des Sciences de Sfax,3000, Sfax, TUNISIE.
[2] Laboratoire de Spectrochimie Infrarouge et Raman (LASIR) UMR-CNRS 8516, 59655, Villeneuve d'Ascq
[3] Laboratory of General Biology, Department of Biology, University of Ha'il, Ha'il 81451, Saudi Arabia

Urtica dioica is a medicinal plant widely recognized for its therapeutic potential, particularly due to its potent antioxidant and anti-inflammatory properties. It has been traditionally used in various cultures for managing inflammatory disorders, metabolic syndromes, and neurodegenerative diseases. The plant's pharmacological significance is largely attributed to its rich composition of bioactive compounds, including flavonoids, phenolic acids, and terpenoids, which contribute to its diverse biological activities.

The phytochemical composition of *Urtica dioica* extract was analyzed to determine its total phenolic and flavonoid content. Antioxidant activity was assessed using radical scavenging assays, ferric reducing antioxidant power (FRAP), ABTS•+ activity, and β-carotene bleaching inhibition. Pharmacokinetic properties were predicted in silico, evaluating drug-likeness based on Lipinski's rule of five, gastrointestinal absorption, blood–brain barrier (BBB) permeability, interactions with P-glycoprotein (P-gp), and the inhibition of cytochrome P450 (CYP) isoforms.

Phytochemical analysis confirmed the presence of bioactive compounds contributing to the extract's strong antioxidant potential, as demonstrated by its high radical scavenging capacity and inhibition of oxidative damage. Pharmacokinetic modeling indicated that the identified compounds exhibited good oral bioavailability, high gastrointestinal absorption, and the ability to cross the BBB, suggesting potential neuroprotective effects. Furthermore, none of the major compounds were substrates for P-gp, and they exhibited minimal inhibition of CYP isoforms, indicating a low risk of drug resistance and interactions.

Urtica dioica demonstrates promising pharmacological potential due to its antioxidant efficacy, favorable pharmacokinetic profile, and neuroprotective properties. These findings support its therapeutic application in oxidative stress-related disorders, including neurodegeneration and chronic inflammation. Further clinical studies are warranted to validate these results and explore its integration into pharmaceutical and nutraceutical formulations.

sciforum-111222: Antioxidant and Anti-inflammatory Properties of Urtica dioica: In Silico, In Vitro, and Phytochemical Analysis

Ahlem Ben chira [1,2,*], Yassine Kadmi [2], Badraoui Riadh [3] and Mohd Saeed [1]

[1] Laboratoire d'Ecophysiologie Animale, Faculté des Sciences de Sfax,3000, Sfax, TUNISIE.
[2] Laboratoire de Spectrochimie Infrarouge et Raman (LASIR) UMR-CNRS 8516, 59655, Villeneuve d'Ascq.
[3] Laboratory of General Biology, Department of Biology, University of Ha'il, Ha'il 81451, Saudi Arabia

Oxidative stress and inflammation are key contributors to various chronic diseases, necessitating the discovery of natural compounds with therapeutic potential. Urtica dioica, commonly known as stinging nettle, has been traditionally used for its medicinal properties, but its essential oil remains underexplored. This study aimed to evaluate the antioxidant properties of Urtica dioica essential oil (UDEO) through an integrative approach involving in silico, in vitro, and in vivo analyses. The phytochemical composition of UDEO was investigated to identify bioactive compounds with significant biological roles. Gas chromatography combined with triple quadrupole mass spectrometry (GC-MS/MS) revealed 97 thermolabile compounds, highlighting the complex chemical profile of the essential oil. To enhance analytical precision, various injection methods using the multimode inlet (MMI) in chromatography were optimized, achieving lower instrumental detection limits. Standard antioxidant assays, including ABTS•+ radical scavenging and total antioxidant capacity (TAC), demonstrated UDEO's strong antioxidative potential. In silico studies further indicated that several identified compounds may target inflammatory mediators such as cyclooxygenase-2 (COX-2), tumor necrosis factor-alpha (TNF-α), and interleukin-6 (IL-6). These findings suggest that UDEO may exert anti-inflammatory effects by modulating key pathways involved in oxidative stress and inflammation.

The study assessed the antioxidant properties of UDEO through a comprehensive approach, revealing its therapeutic potential in managing oxidative stress and inflammatory conditions. This work underscores the importance of exploring essential oils as a source of natural bioactive compounds for pharmacological applications.

sciforum-108788: Antioxidant and antitumor activity of *Lycium chinense* Linn. cultivated in Ukraine against colorectal cancer cells

Svetlana Lyashenko [1,*], Natalia Boiko [2], Victoriia Soloshenko [2] and José Luis Guil-Guerrero [1]

[1] Food tecnology, University of Almería, Almeria, 04120, Spain
[2] Department of dendroflora enrichment, Seed laboratory, The «Olexandria» State Dendrological Park of the National Academy of Science of Ukraine, Bila Tserkva, 09113, Ukraine

Introduction

Lycium fruits, commonly known as "goji berries," are recognized as superfoods with diverse bioactive properties. *Lycium chinense* has been introduced in the dendrological park "Olexandria" in the northeastern part of the Right Bank Forest-Steppe of Ukraine, yet data on the bioactivity of the goji berries grown there remain limited. This study aims to evaluate the antioxidant and anticancer potential of *L. chinense* cultivated in Ukraine.

Methods

Defatted berries were extracted with methanol/water (60:40, v/v) using a Soxhlet apparatus. The extract was used for the determination of total phenolic content (TPC) and total flavonoid content (TFC) through the Folin–Ciocalteu and AlCl3 procedures, respectively. Antioxidant activity was assessed using DPPH radical scavenging and β-carotene bleaching assays, while antiproliferative effects were evaluated by the MTT assay.

Results

The hydroalcoholic extraction of goji berries under the previously described conditions yielded 16.9% in dry weight. TPC was 11.3 mg GAE/g DW fruits, while TFC was 7,3 mg rutin/g DW. The extract demonstrated significant antioxidant capacity (DPPH IC50 = 125.9 ± 12.6 µg/ml) and lipid peroxidation inhibition (23.5 ± 2.1% in the β-carotene assay). The MTT assay showed concentration- and time-dependent inhibition of HT-29 colorectal cancer cells (GI50 at 72 h = 250 µg/ml) with a selectivity index (SI) of 13 against CCD-18 normal cells, indicating strong selectivity.

Conclusions

This is the first study to report on the antioxidant and anticancer properties of *L. chinense* cultivated in Ukraine. The findings suggest that Ukrainian goji berries are a promising source of natural antioxidants and demonstrate notable antiproliferative effects on HT-29 cells. Further research should explore the goji berries' polyphenolic composition, assess their local cultivars, and investigate potential uses for goji berry by-products.

sciforum-111750: Benzimidazole-Based Antioxidants: A Computational Study on Lipoxygenase Inhibition

Ibrahim Gidado [1,2,*], Idris Yunusa Abdullahi [2], Hamza Nasiru Asma'u [2], Abdullahi Maryam [2], Lukman Ali Hassan [2] and Jimoh Yusuf [2]

[1] Department of Chemistry, Federal College of Education, Yola, Nigeria
[2] Department of Pharmaceutical and Medicinal Chemistry, Ahmadu Bello University, Zaria, Nigeria

Oxidative stress is an imbalance between the reactive oxygen species (ROS) and the endogenous antioxidant defense system in the body. Oxidative stress can injure cells in several ways, contributing to various diseases, such as atherosclerosis, cardiovascular disease, Alzheimer's disease, and cancer. Lipoxygenase (LOX) is a family of non-heme iron-containing enzymes known for their catalysis of lipid peroxidation via the oxidation of polyunsaturated fatty acids (PUFAa). Oxidative stress can lead to the peroxidation of lipids, which can alter the substrate specificity and activity of LOX enzymes. This study aims to design benzimidazole derivatives and evaluate their antioxidant activity using an in silico approach. An oral bioavailability prediction was carried out using an online web server (ADMETlab 2.0). The compounds were designed, optimized, and prepared using ChemDraw 12.0, Spartan14, and UCFS Chimera. The molecular docking of the compounds in the LOX enzyme was carried out using AutoDock Vina. All the designed ligands passed Lipinski's rule of five, which means that they are all druggable. All the ligands have a good synthetic accessibility score (6). The docking results showed that the ligands have a good binding affinity to the target, the LOX enzyme (1N8Q), with L20 having the best binding affinity (-6.0 Kcal/mol). The native ligand (DHB: 3,4-DIHYDROXYBENZOIC ACID) has a binding score of -5.7 Kcal/mol. Ascorbic acid was used as a reference drug and had a binding score of -5.4 Kcal/mol. The results indicated that ligands interacted with the binding pockets of the enzyme's active site through conventional hydrogen bond, hydrogen bond, Van der Waals, Pi-Pi, Pi-alkyl, pi-anion, and alkyl interactions. The interacting amino acid residues responsible for the scavenging activity are HIS518, GLN514, LEU515, HIS523, ALA561, TRP519, and ILE572. This study suggested that designed benzimidazole ligands have the potential to scavenge free radicals.

sciforum-112975: Chemical profile and Antioxidant activity of *Allium chamaemoly* L. subsp. *chamaemoly* from Sicily (Italy)

Roberta Pino [1,*], Rosa Tundis [1], Monica Rosa Loizzo [1], Maurizio Bruno [2], natale Badalamenti [2] and Vincenzo Ilardi [3]

[1] Department of Pharmacy, Health and Nutritional Sciences, University of Calabria, 87036 Arcavacata di Rende (CS), Italy.
[2] Department of Biological, Chemical and Pharmaceutical Sciences and Technologies, University of Palermo, Viale delle Scienze, Parco d'Orleans II, IT-90128 Palermo, Italy
[3] Department of Earth and Marine Sciences, University of Palermo, Via Archirafi, 26 Palermo, Italy

---

This study aimed to evaluate the total phenol content (TPC) and total flavonoid content (TFC) involved the composition and antioxidant activity of *Allium chamaemoly* L. subsp. *chamaemoly* (Amaryllidaceae), known in Italy as "Agghiu di li maghi" [1]. Bulbs were dried for 10 days in the shade, blended, and then extracted with ethanol EtOH, giving us an extraction yield of 1.17%. The TPC and TFC were measured using the Folin–Ciocalteu method, whereas the aluminium chloride colorimetric assay was applied to evaluate just the TFC [2]. The antioxidant activity was assessed by using 2,2′-azinobis-(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS), and 2,2-diphenyl-1-picrylhydrazyl (DPPH), and β-carotene bleaching tests) [2]. Bulbs contained 56.22 and 18.88 mg/g extract of TPC and TFC, respectively. Different radical scavenging power was observed using ABTS and DPPH tests with IC_{50} of 287.13 mg/mL and 44,32% inhibition at 1000 mg/mL, respectively. In fact, the differences between these activities can be ascribed to the reaction media. The DPPH assay is conventionally conducted under a concentration of 50% ethanol /water, while the ABTS assay is carried out in aqueous conditions. In our case, it was possible to observe that thebulb's phenols are more soluble in aqueous reaction media. IC50 values of 66.23 and 62.47 μg/mL were found in the β-carotene bleaching test after 30 and 60 minutes of incubation, respectively. In conclusion, our investigation revealed that *Allium chamaemoly* L. subsp. *chamaemoly* is a healthy spice with a promising content of bioactive compounds and antioxidant activity.

References

[1] Pignatti, S.; Guarino, R.; La Rosa, M. - *Flora d'Italia*; Edagricole, Bologna, II edizione, **2017**, vol. 1, pp. 248-249;
[2] Loizzo, M.R.; Tundis, R.; Sut, S.; Dall'Acqua, S.; Ilardi, V.; Leporini, M.; Falco, T.; Sicari, V.; Bruno, M. High-Performance Liquid Chromatography/Electrospray Ionization Tandem Mass Spectrometry (HPLC-ESI-MSn) Analysis and Bioactivity Useful for Prevention of "Diabesity" of Allium commutatum Guss. *Plant Foods Hum Nutr*. **2020**, 75, 124-130.

sciforum-114083: Effects of commercial standardized green rooibos (Aspalathus linearis) powdered extract on zebrafish behavior

Sonia Guilera Bermell [1], Patricia Martorell Guerola [1], Vanesa Robles [2], David G. Valcarce [2], Marta F. Riesco [2] and Antonio M. Inarejos Garcia [1,*]

[1] Archer Daniels Midland, Nutrition, Health&Wellness, Biopolis S.L. Parc Científic Universitat de València, 46980 Paterna, Spain
[2] Área de Biología Celular, Departamento de Biología Molecular, Universidad de León

Rooibos (Aspalathus linearis) is a legume originally from Africa. Rooibos can come “unfermented” (green rooibos) or “fermented” (rooibos). The latter is obtained through an oxidation process controlling temperature and time. Apart from their different organoleptic properties, “fermented” and “unfermented” products also present different chromatographic profiles, with the dihydrochalcone aspalathin being the major antioxidant affected after processing.

In the present study, a commercial green rooibos powdered extract standardized to dihydrochalcones (aspalathin, nothofagin) and flavones (orientin, isorientin, vitexin…), together with the corresponding volatile fingerprint (safranal, damascenone…), was evaluated in a zebrafish model. The experimental groups were “control” (fed with commercial standard feed) and “Treatment” (fed with the standard feed including the green rooibos extract) groups. The protocol was performed twice, at 2 and 4 months post the start of ingestion, as follows: Each animal was individually placed at the bottom of a quadrangular glass aquarium (20x8x18 cm; length x width x depth; swimming volume: 3.5 L). The fish were filmed (1920 x 1080 px) for 6 min. The 1st minute was considered the time required to acclimate to the new environment, and the behavior analysis was considered for the remaining 5 min. Individual swimming activity was analyzed using Noldus Ethovision® tracking software, generating a virtual grid dividing the tank into two areas (upper and lower).

A standard diet including 0.05% green rooibos extract may modulate the behavior of zebrafish after 4 months of its continuous ingestion. This change in swimming patterns is associated with a state of lower anxiety in the zebrafish model. These results are supported by the trend towards lower latency to the first entry at the top of the tank.

sciforum-112756: Exploring *Limonia acidissima*: The Nutritional and Medicinal Secrets of Wood Apple

Harsha Ambalal Patil *, Mansi Amitkumar Dhankani and Amitkumar Rajkumar Dhankani

P.S.G.V.P.Mandal,s College of Pharmacy, Shahada,Dist.-Nandurbar,425409, India

The wood apple, or *Limonia acidissima* Groff, is a tropical fruit that is a member of the Rutaceae family. It grows extensively in Southeast Asia and has its origins in Sri Lanka, India, and Myanmar. This fruit has a long history of use in traditional medicine due to its remarkable nutritional and medicinal properties. Wood apple pulp is high in β-carotene, a precursor to vitamin A. It also contains a lot of B vitamins, such as riboflavin and thiamine, and trace levels of ascorbic acid. Furthermore, a variety of phytochemicals associated with L. acidissima have been linked to health benefits such as antioxidant, hepatoprotective, antimicrobial, neuroprotective, antidiabetic, anti-inflammatory, analgesic, antiulcer, and antihyperlipidemic properties. These include polyphenolic chemicals, saponins, phytosterols, tannins, triterpenoids, coumarins, and amino acids. According to the findings of several studies, wood apple fruit has a high anticancer effect because it inhibits cancer cell multiplication. The wood apple finds wide-ranging commercial applications, which include the preparation of ready-to-drink beverages, syrups, jellies, chutneys, and a variety of other food products. In conclusion, this review discusses the nutritional and phytochemical contents of wood apple, shows its antioxidant, anti-inflammatory, and anti-diabetic properties, and investigates its potential for value-added product creation. Nonetheless, it is critical to recognise that the molecular mechanisms behind these traits remain an unexplored domain. To assure the safe integration of wood apple fruit into the culinary, cosmetics, and pharmaceutical industries, comprehensive clinical trials with toxicity evaluations are required. This review offers a comprehensive look at this fascinating fruit, detailing its health benefits, nutritional profile, and traditional uses in medicine.

sciforum-116173: In Silico Comparative Analysis of Phytochemicals from Rubus fruticosus with relevance for neurodegenerative disease

Paula Denisa Saragea * and Lucian Hriţcu

Biology Department, “Alexandru Ioan Cuza” University, Iași, Romania

This study focuses on an in silico comparative and descriptive analysis of the phytochemical compounds in *Rubus fruticosus* (blackberry) using the computational tool SwissADME, with an emphasis on their potential applicability to neurodegenerative diseases such as Alzheimer’s disease (AD). SwissADME enables the prediction of comprehensive pharmacokinetic profiles, including gastrointestinal absorption (HIA), blood–brain barrier (BBB) permeability via the BOILED-Egg model, and drug likeness. Moreover, this study evaluates the probability of these compounds being actively effluxed by P-gp (PGP+), which is crucial for assessing their bioavailability and potential therapeutic effectiveness in the central nervous system. The interaction of phytochemicals with P-gp can significantly influence their ability to penetrate the BBB, with higher efflux probabilities indicating reduced central nervous system accessibility. Additionally, similarities and differences between these compounds are highlighted to assess their therapeutic potential.

Using SwissTargetPrediction and SwissDock, this study further evaluates the interaction of these phytochemicals with crucial enzymes and molecular targets involved in neurodegeneration, such as β-secretase and acetylcholinesterase (implicated in amyloid plaque formation and cholinergic signaling); kinases like GSK3β, CDK5, and ERK2 (involved in tau protein hyperphosphorylation and neurodegeneration); β-amyloid protein; and microtubule-associated protein tau (amyloid plaques and NFTs—critical in AD pathology).

Key bioactive compounds from *Rubus fruticosus*—noted for their antioxidant, anti-inflammatory, and neuroprotective effects—are compared against established AD treatments, including galantamine and rivastigmine.

This comparative analysis underscores the potential of *Rubus fruticosus* phytochemicals as viable candidates for developing treatments for neurodegenerative diseases, with the potential to enhance cognitive function and delay or slow disease progression in conditions like AD. By integrating computational methods into our analysis, this research seeks to facilitate the discovery and development of new drugs from natural sources, like *Rubus fruticosus*, while emphasizing the necessity of experimental validation to confirm bioinformatic predictions.

sciforum-113941: In silico design and discovery of novel 2-pyrazoline methanone derivatives as antioxidant agents for cosmetic applications: A bioinformatics analysis and molecular docking study

Yusuf Jimoh [1,*], Asmau Nasir Hamza [1], Maryam Abdullahi [1], Abdullahi Yunusa Idris [1], Amina Busola Olorukooba [2], Lukman Ali Hassan [1] and Ibrahim Gidado [3]

[1] Department of Pharmaceutical and Medicinal Chemistry, Ahmadu Bello University, Zaria, Nigeria
[2] Department of Pharmacology and Toxicology, Faculty of Pharmaceutical Sciences, University of Abuja, Gwagwalada-Nigeria
[3] Department of Chemistry, Federal College of Education, Yola, Nigeria

The cosmetic industry's growing demand for effective antioxidants has spurred extensive research into novel compounds. This study explores the potential of 2-pyrazoline methanone derivatives as antioxidant agents for cosmetic applications using advanced computational methods. The designed 2D structures of 2-pyrazoline methanone derivatives were created using ChemDraw and optimized in 3D using Spartan14 software. Human erythrocyte catalase (PDB ID: 1DGB) was prepared for molecular docking simulations conducted with AutoDock Vina. Theoretical oral bioavailability was assessed using Lipinski's rule of five, which indicated that all designed compounds adhered to the criteria for good bioavailability. Post-docking analysis was performed using Biovia Discovery Studio to evaluate binding affinities and interactions. The designed compounds demonstrated favorable theoretical oral bioavailability, adhering to Lipinski's rule of five. Molecular docking simulations revealed significant binding affinities between the novel compounds and Human erythrocyte catalase, with binding energies comparable to the co-crystallized ligand (HEM). Specific interaction types, including hydrogen bonds and hydrophobic interactions, were identified through post-docking analysis, highlighting the stability of these interactions. The promising binding affinities and interactions observed suggest that these 2-pyrazoline methanone derivatives could effectively target the antioxidant defense system, potentially enhancing catalase activity and overall skin protection. The computational approach employed aligns with current trends in cosmetic science, demonstrating the power of in silico methods in accelerating the discovery of new cosmetic ingredients. This study highlights the potential of novel 2-pyrazoline methanone derivatives as effective antioxidant agents for cosmetic applications. While the in silico results are encouraging, further experimental validation is necessary to confirm the efficacy and safety of these compounds in biological systems, paving the way for future research in this area.

sciforum-110962: Integration of Antioxidant Responses with Secondary Metabolism in Plants under Abiotic Stress

Pan Zhiyong [1, 2], Mian Muhammad Ahmed [3,4,*] and Hamid Syeda Maira [3,5]

[1] College of Horticulture and Forestry Sciences, Huazhong Agricultural University, Wuhan, P.R. China
[2] National Key Laboratory for Germplasm Innovation & Utilization of Horticultural Crops, Huazhong Agricultural University, Shizhishan Street, Hongshan District, Wuhan, Hubei, 430070 China.
[3] College of life Science and Technology, Tarim University, Alar, Xinjiang, 843301, China
[4] National and Local Joint Engineering Laboratory for High-Efficiency and High-Quality Cultivation and Deep Processing Technology of Characteristic Fruit Trees in Southern Xinjiang, China
[5] Key Laboratory of Protection and Utilization of Biological Resources in Tarim Basin, Alar, Xinjiang, China.

The growth, development, and production of plants are severely hampered by abiotic conditions such as drought, salinity, high temperatures, and heavy metal toxicity. Reactive oxygen species (ROS) are produced in excess as a result of these stressors, which damages biomolecules and cellular structures oxidatively. Plants have developed complex antioxidant systems that include nonenzymatic antioxidants such as ascorbate, glutathione, carotenoids, and phenolic substances, as well as enzymatic antioxidants like superoxide dismutase (SOD), catalase (CAT), and peroxidases (POD). Secondary metabolites, such as flavonoids, alkaloids, and terpenoids, are essential for reducing oxidative stress and boosting plant resistance in addition to these antioxidant defenses. The complex interactions between secondary metabolism and antioxidant responses in plants under abiotic stress are examined in this review. Secondary metabolites' dual function as signaling molecules and ROS scavengers is examined, with a focus on how they support stress adaptation and redox equilibrium. Additionally, the way that ROS and antioxidants control the formation of secondary metabolites is investigated, providing insight into the dynamic feedback processes at play. Recent developments in molecular biology and omics technologies have demonstrated that transcription factors and signaling networks, including the MYB, bHLH, and WRKY families, as well as hormonal cross-talk involving abscisic acid, salicylic acid, and jasmonic acid, co-regulate antioxidant and secondary metabolic pathways. This study also emphasizes how biotechnological methods, such as genetic engineering and the use of exogenous elicitors, can be used to enhance plant stress tolerance by utilizing the integration of secondary metabolic pathways and antioxidants. Gaining insight into how these two systems work together offers encouraging opportunities to improve agricultural sustainability in the face of changing climate circumstances and create stress-resilient crops.

sciforum-109514: Kitchen Strategies: How to Preserve Antioxidants When Cooking Vegetables

Niraj Kumar Prajapati [1,*] and Sanjay Kumar [2]

[1] Department of Horticulture, SAST, Babasaheb Bhimrao Ambedkar University, Lucknow (U.P.) - 226025
[2] Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University (A Central University), Lucknow (U.P.) – 226025

The preservation of antioxidants during vegetable preparation and cooking remains a critical concern in both domestic and commercial food preparation. This study synthesizes current research on optimal cooking methods and their impact on the retention of vital phytochemicals in commonly consumed vegetables. Studies indicate that water-based cooking methods can result in a 20-60% loss of water-soluble antioxidants, particularly vitamin C and polyphenols. Steam cooking emerges as a superior method, preserving up to 80% of antioxidant content compared to boiling. The application of minimal thermal processing techniques, maintaining temperatures below 120°C, demonstrates significant benefits in retaining heat-sensitive compounds. Research reveals that lipid-soluble antioxidants, including carotenoids and vitamin E, show enhanced bioavailability when vegetables are prepared with small amounts of healthy fats, increasing absorption rates by 2.4-5 times. Mechanical processing techniques, such as chopping and slicing, should be minimized or performed immediately before cooking, as cellular disruption can lead to the enzymatic degradation of beneficial compounds. Notably, some vegetables, including tomatoes and carrots, exhibit increased antioxidant activity when subjected to moderate heat treatment, with lycopene availability increasing by up to 164% through controlled cooking. The implementation of time—temperature optimization proves crucial, with brief cooking durations (3-5 minutes) at moderate temperatures (85-95°C) showing optimal results for most vegetables. This research also addresses the significance of proper storage conditions, suggesting that storing vegetables at 4°C can preserve up to 90% of their antioxidant content for 5-7 days. These findings provide evidence-based recommendations for both home cooks and food service professionals to maximize the nutritional benefits of prepared vegetables while maintaining their sensory qualities.

sciforum-111815: Lichens of the genus *Parmelia*: a promising source of antioxidant compounds with pharmacological applications

Nicolás Millar [1], Joaquín Sandoval-Vargas [2,*], Andrea Lleucun [1], Karin Pinuer [2], Mario Simirigiotis [1] and Alfredo Torres-Benítez [2]

[1] Instituto de Farmacia, Facultad de Ciencias, Universidad Austral de Chile, Campus Isla Teja, Valdivia, Chile
[2] Carrera de Química y Farmacia, Facultad de Medicina y Ciencia, Universidad San Sebastián Sede Valdivia, Chile

Parmelia is a genus of foliose lichens belonging to the Parmeliaceae family, distributed worldwide, and includes approximately 300 species. Along with other lichen groups, it reports a highly varied chemical composition with multiple biological activities. A compilation and analysis of recent research on the bioactive compounds present in species of the genus *Parmelia* and the results of their antioxidant properties were carried out. The characterization of the chemical constituents of 24 species revealed the presence of atranorin, chloratranorin, leucotylin, alectorialic, atraric, baeomycesic, caperatic, diffractaic, divaricatic, evernic, glomelliferic, gyrophoric, isonephrosterinic, isousnic, lecanoric, leucotylic, lichesterinic, nephrosterinic, norstictic, orsellinic, oxyphysodic, protocetraric, protolichesterinic, salazinic, stenosporic, stictic, usnic, 2-hydroxy-4-methoxy-3,6-dimethylbenzoic acids, arabinitol, zeorin, ethyl haematommate, ethyl orsellinate, ethyl-2,4-dihydroxy-6-methylbenzoate, methyl-β-orsellinate, orcinol, β-sitosterol, and α-tocopherol, among others. Extracts prepared with solvents and aqueous extracts from species such as *P. sulcata, P. caperata, P. saxatilis, P. omphalodes, P. perlata, P. conspersa, P. arseneana, P. pertusa, P. cirrhatum, P. crinita*, and *P. erumpens* have shown outstanding antioxidant activity in a variety of tests, including DPPH, ABTS, and total phenolic and flavonoid content measurements. The results of these tests indicated moderate-to-high antioxidant activities, depending on the concentration of the extracts used. Likewise, the major isolated compounds from these species showed significant antioxidant activity, which compares favorably with the reference standards used in the research, and in some cases, the results were even superior. In assays with cell lines of human colon carcinoma, the human lung, breast cancer, malignant melanoma, and chronic myelogenous leukemia, some extracts show high cytotoxic effects that are proportional to the concentration of the phenolic content. The genus *Parmelia* exhibits remarkable chemical diversity, with the presence of secondary metabolites that have demonstrated significant antioxidant properties, supporting its potential use in the prevention and treatment of diseases related to oxidative stress and the development of pharmaceutical products.

sciforum-108078: Multifunctional Agents in the Treatment of Alzheimer's Disease: A Preliminary Investigational Study

Ilaria D'Agostino [1,*], Bianca Laura Bernardoni [1], Fabio Scianò [1], Giovanni Petrarolo [1], Lidia Ciccone [1], Susanna Nencetti [1], Manuela Leri [2], Monica Bucciantini [2] and Concettina La Motta [1]

[1] Department of Pharmacy, University of Pisa, Via Bonanno 6, 56126 Pisa, Italy
[2] Department of Experimental and Clinical Biomedical Sciences "Mario Serio", University of Florence, Viale Morgagni 50, 50134 Florence, Italy

Alzheimer's disease (AD) is a multifactorial neurodegenerative disorder with a high incidence rate in older people worldwide.[1] Apart from its widely recognized hallmarks, such as β-amyloid (Aβ) plaques and hyperphosphorylated tau proteins, neuroinflammation, oxidative stress, and metal ion accumulation were found to severely contribute to the disease's progression.[2] Within this intricate framework, sirtuin-1 (SIRT1) has gained attention as a potential AD preventive factor, since it is involved in oxidative stress responses and brain homeostasis.[3] AD's high degree of complexity seems to justify the limited success of current single-target therapies and the recent shift of the research programmes towards multifunctional agents able to target multiple mechanisms simultaneously, with additive or even synergistic effects to more effectively counteract disease progression.

In this study, we present a series of previously reported SIRT1 activators featuring a 2,6-diphenylimidazo[1,2-*a*]pyridine core[4] for potential anti-AD applications. We expanded the compound library by decorating the phenyl rings with various methoxy and/or hydroxy groups. Due to their polyphenolic nature, they showed antioxidant properties in vitro, as assessed in vitro through DPPH and ABTS assays and TBARS using rat brain homogenate. Also, although with specific preferences, some compounds showed metal-chelating abilities towards Cu^{2+}, Zn^{2+}, and Fe^{2+}.

Notably, in differentiated SH-SY5Y cells, a recognized AD model, compound **CLM400** was demonstrated to reduce oxidative stress when tested at 2.5 nM, whereas a pro-oxidant effect was observed at higher concentrations. Interestingly, TEM analyses revealed the compound's ability to form larger, non-toxic off-pathway Aβ aggregates with a pro-aggregating behavior. This finding is particularly relevant and aligns with previous studies on resveratrol, while traditional anti-AD agents often focus on inhibiting aggregation into toxic soluble oligomers.

This preliminary study highlighted a new series of multifunctional agents as promising agents for AD treatment. However, in-depth studies are required to shed light on the formed aggregates.

sciforum-113637: Nano-Antioxidants: A New Frontier In Antioxidant Delivery Systems

Sana Azhar

National Institute of Food Science and Technology, FFNHS, University of Agriculture Faisalabad(37000), Pakistan

Antioxidants are either man-made or natural substances that neutralize free radicals and prevent or delay some types of cell damage caused by oxidative stress, even at low concentrations. They can be classified as endogenous (glutathione and uric acid) and exogenous. Exogenous antioxidants include natural antioxidants, synthetic antioxidants like butylated hydroxytoluene (BHT), BHT analogs, butylated hydroxy-anisole (BHA) and Gallic Acid (GA) esters, nanoscale inorganic materials, and the most controversial and most recently discovered nano-encapsulated antioxidant molecules. Several foods, including fruits and vegetables, possess antioxidant potential, like vitamins (A, C, E, B3), carotenoids (lutein, β-carotene), and polyphenols (3,6-dihydroxyflavone), which exhibit free radical-scavenging activity. They are considered potent therapeutic agents for several ailments. However, some natural antioxidants possess poor water solubility, storage instability, and limited bioavailability due to their poor absorption and their degradation upon delivery. Synthetic antioxidants can cause reductive stress, which limits their applications. To overcome these problems, inorganic nanoparticles have been thoroughly studied for their antioxidant properties, and recently, nano-antioxidants have shown the ability to ameliorate oxidative stress with higher sensitivity, cellular antioxidant activity, lowest cytotoxicity, and targeted delivery. Nano-antioxidants are nanoparticles that are capable of capturing chain-carrying radicals and decreasing the number of initiation processes to alleviate the rate of autoxidation. Despite having their own antioxidant potentials, nanomaterials can be used as passive delivery systems for smaller antioxidants. Various combinations, including covalent interaction or the encapsulation of antioxidants with a variety of nanomaterials such as inorganic nanomaterials, metal nanomaterials, natural polymer-based nanomaterials, liposomes, or protein-polysaccharide-based conjugated nanomaterials, have been developed and are under examination for diverse applications. Nanomaterials are optimal for medicine and drug delivery systems because of their smaller size and extensibility. However, a complete understanding of the mechanism of action, origin, and physical and chemical nature of nano-antioxidant composites is required to understand their biological and catalytic activity.

Keywords: antioxidants; nanoantioxidants; oxidative stress; free radicals.

sciforum-111774: Natural antioxidants: A review of their sources, properties, and health benefits

Hemangi Somnath Chaudhari *, Javesh Kashinath Patil, Bhagyashri Sandip Patil and Bhagyashri Sunil Patil

PSGVP Mandals college of pharmacy Shahada, 425409 dist Nandurbar, India.

Natural antioxidants, derived from plants, fruits, vegetables, and other natural sources, have been recognized for their potential health benefits. Natural antioxidants have gained widespread attention due to their potential therapeutic properties and their role in protecting human health from oxidative stress-related disorders. Natural antioxidants are crucial for reducing the harmful effects of reactive oxygen species (ROS), free radicals (FRs), and reactive nitrogen species (RNS), which are linked to oxidative stress (OS) and a number of illnesses and ailments. With an emphasis on the division of natural antioxidants into two classes—enzymatic and non-enzymatic—including polyphenols (phenolic compounds and flavonoids) and vitamins, this review explores the production of these reactive species as well as the idea of OS. The human body's innate antioxidant defence systems are presented, demonstrating the synergy between multiple processes in preventing oxidative damage. The benefits of these natural antioxidants in scavenging free radicals have been extensively discussed and published in previous studies. The health benefits of natural antioxidants, including their anti-inflammatory, anti-cancer, cardiovascular protective, and neuroprotective effects, are also examined. Characteristics that encourage the use of natural antioxidants include their low cost, compatibility with food, and their less adverse effect in the human body. Furthermore, the importance of medicinal plants as antioxidant-rich sources is stressed, opening up new options for health promotion and illness prevention. This comprehensive overview aims to improve understanding and appreciation of natural antioxidants, their mechanisms, applications, and the delicate balance required for their safe and successful usage in health maintenance and disease prevention. Additionally, they support immune function, improve heart health, and reduce the risk of developing chronic diseases. This review summarizes the various natural sources of antioxidants, explores their chemical properties, and examines the scientific evidence supporting their health benefits.

sciforum-108002: Organic sunscreens and their environmental degradation products: an in silico study of interactions with enzymatic antioxidant systems in the human placenta

Anna W. Sobańska [1] and Andrzej Michał Sobański [2,*]

[1] Department of Analytical Chemistry, Faculty of Pharmacy, Medical University of Lodz, Lodz, 90-151, Poland
[2] Faculty of Chemistry, University of Lodz, Lodz, 91-403, Poland

The main function of the placenta is to facilitate and regulate the mother-to-fetus transport of oxygen and nutrients. The placenta is also responsible, due to some enzymes present within it, for protecting the fetus against harmful xenobiotics. One of the protective mechanisms of the placenta is linked to the antioxidant enzyme glutathione *S*-transferase. Enzymes from this family can detoxify many endogenous compounds and break down xenobiotics through the conjugation of various substrates with reduced glutathione.

Organic sunscreens are expected to protect the skin, hair, and materials such as cosmetics or fabrics against the harmful effects of UV radiation. Unfortunately, many compounds from this group are known to cross biological barriers; they are found in the mother's milk, umbilical cord blood, or placental tissues. Some organic sunscreens are able to cross the placenta and to interfere with fetal development; they are known or suspected to be endocrine disruptors or neurotoxins.

In this study, 16 organic sunscreens and over 100 products of sunscreen degradation in biotic and abiotic conditions were investigated in the context of their interactions with the enzyme gluthatione S-transferase present in the human placenta. Molecular docking analysis proved that several compounds from the studied group show stronger affinity for glutathione S-transferase that glutathione; it is therefore possible that they are able to reduce the enzyme's antioxidant activity. It was established that sunscreens and their degradation products bind to glutathione S-transferase mainly by hydrogen bonds, but there are also van der Waals, pi-pi, pi-alkyl, and pi-sulfur interactions that contribute to the stability of enzyme—ligand complexes.

To conclude, due to the complexity of sunscreens' degradation pathways and he abundance of both parent sunscreens and their degradation products in the environment, a relatively small group of popular cosmetic ingredients may be a source of a considerable number of stressors affecting individuals at different stages of development.

sciforum-108757: Phytochemical Composition and In Vitro Antioxidant Activity of Hibiscus sabdariffa.

Oyidiya Chukwu Orji [1,*] and Florence C Nworah [2]

[1] Biochemstry, pharmacology, University of Nigeria, Nsukka, Enugu State, 41001
[2] Pharma-biology, University of Nigeria, Nsukka, Enugu State, Nigeria, 410001

Abstract

Hibiscus sabdariffa calyxes has long been used in traditional food and medicine, including cold or hot drinks, jellies, puddings, and as flavoring agents. This study evaluated the phytochemicals composition and in vitro antioxidant activities of *Hibiscus sabdariffa* calyxes in aqueous extract form. The analysis qualitatively and quantitatively identified several phytochemicals, revealing 4634.41 ± 10.75 mg of total phenolics, 329.99 ± 4.57 mg of alkaloids, 179.38 ± 0.83 mg of flavonoids, 14.42 ± 0.23 mg of tannins, 1.69 ± 0.00 mg of glycosides, 3.45 ± 0.00 mg of steroids, 173.48 ± 0.13 mg of reducing sugars, and 137.70 ± 2.77 mg of terpenoids per 100 grams of extract. The antioxidant activity was measured through several assays. The DPPH radical scavenging assay resulted in an EC50 of 34.89 µg//ml, compared with the standard at 29.9 µg//ml. Lipid peroxidation inhibition showed an EC50 of 8.53 µg//ml, compared to 2.73 µg//ml for the standard. Nitric oxide scavenging had an EC50 of 3.217 µg//ml, while the standard was shown to have a value of 0.895 µg//ml. The ferric reducing antioxidant power (FRAP) assay demonstrated the extract's ability to reduce Fe^{3+} to Fe^{2+}. Additionally, the extract reduced molybdenum (vi) to molybdenum (v). This study on *Hibiscus sabdariffa* calyxes confirms that the aqueous extract from *Hibiscus sabdariffa* calyxes is rich in phenolics, contributing to its antioxidant properties and supporting its traditional medicinal uses.

Keywords: *Hibiscus sabdariffa*, antioxidant, phytochemicals, calyxes

sciforum-114654: Protective Antioxidants in Seafood: Supporting Health and Combating Disease

Ana Olívia Serra Jorge [1,*], F. Chamorro [2], M. Carpena [2], J. Echave [2,3], E. N. Yuksek [2], M. Beatriz P. P. Oliveira [4] and M.A. Prieto [2]

[1] REQUIMTE/LAQV, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, R. Jorge Viterbo Ferreira 228, 4050-313 Porto, Portugal
[2] Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain.
[3] CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300- 253 Bragança, Portugal
[4] LAQV@REQUIMTE, Department of Chemical Sciences, Faculdade de Farmácia, Universidade do Porto, R. Jorge Viterbo Ferreira 228, 4050-313, Porto, Portugal.

Antioxidants from seafood play a crucial role in promoting human health by providing a natural source of compounds that mitigate oxidative stress. Oxidative stress, usually as a result of antioxidant imbalance, is strongly linked with DNA damage, inflammation, metabolic diseases, and other hazardous events. This intricate process can be ameliorated by endogenous antioxidant enzymes and molecules, but also by intake of antioxidants naturally present in food. Seafood is rich in bioactive antioxidants like astaxanthin, tocopherols, selenium, coenzyme Q10, glutathione, and omega-3 fatty acids, all of which have demonstrated significant potential in reducing cellular oxidative damage.

Some antioxidants in fish, such as astaxanthin, tocopherols, and selenium, collaborate in mitigating oxidative stress by neutralizing free radicals. This action helps to reduce cellular damage, thereby lowering the risk of chronic diseases such as cancer, cardiovascular diseases, and neurodegenerative disorders. Astaxanthin, a carotenoid found in certain fish species like salmon and trout, is known for its superior antioxidant capacity, surpassing vitamin E and other carotenoids. Tocopherols (vitamin E compounds) also contribute to the prevention of lipid oxidation in cell membranes, enhancing cellular integrity and function. Selenium, an essential trace mineral in fish, is a component of selenoproteins with critical antioxidant functions, protecting against oxidative damage and supporting immune function. Additional antioxidants such as coenzyme Q10, found in fish like sardines and mackerel, contribute to cellular energy production while neutralizing free radicals. Glutathione, present in various types of seafood, supports detoxification pathways and bolsters cellular antioxidant defense systems.

This review synthesizes the mechanisms, health benefits, and dietary implications of seafood-derived antioxidants, providing insights into their potential for enhancing human health.

sciforum-113887: Structural descriptors and antioxidant activity markers of 4-[4-(2-aminoetoxy)benzyl]aniline

Dmitry Filimonov [1], Alexander Eresko [2,*], Nadezhda Trubnikova [1], Irina Kisilenko [1], Margarita Belotserkovskaya [1], Elena Raksha [2] and Dorota Marta Chudoba [2]

[1] Federal State Budgetary Institution "V.K. Gusak Institute of Emergency and Reconstructive Surgery" of the Ministry of Health of the Russian Federation, Donetsk, 283045, Russia
[2] Frank Laboratory of Neutron Physics, Joint Institute for Nuclear Research, Dubna, 141980 Russia

The release of reactive oxygen species accompanying oxidative stress is one of the most important damaging mechanisms during brain ischemia. Despite some failures in clinical trials, antioxidant therapy remains one of the best strategies for neuroprotection. Thyroid hormone signaling pathways can control redox status; however,the antioxidant effects of their bioactive metabolites are still less well known, especially for thyronamines.

The chemical species distribution at different pH values for 4-[4-(2-aminoethoxy)benzyl]aniline (T0AM thyronamine synthetic analogue) was estimated with the Marvin Protonation Plugin. The 2-{4-[(4-Aminophenyl)methyl]phenoxy}ethan-1-aminium cation is the main species in the pH 6.6-7.4 range. Molecular modeling of the structure and an evaluation of some structural descriptors were performed for the 2-{4-[(4-aminophenyl)methyl]phenoxy}ethan-1-aminium cation. A combination of the PM6-DH2 and B3LYP/6-31G(d,p) levels of theory was used to investigate the intramolecular dynamics of the considered protonated thyronamine.

Some aspects of the antioxidant activity of 4-[4-(2-aminoethoxy)benzyl]aniline in the model of acute cerebral ischemia were experimentally studied and discussed. In a rat brain hemisphere ischemia model, ligation of the internal carotid artery through the administration of a synthetic analogue of the thyronamine T0AM was associated with significant changes in redox markers: a lower level of malondialdehyde in the ischemic hemisphere ($p = 0.022$) and increased activity of glutathione peroxidase ($p = 0.004$) and superoxide dismutase levels ($p = 0.042$) in the ischemic hemisphere. Also, in an $FeCl_3$ model of local brain infarction, the administration of a T0AM analog was associated with a significant increase in neuroglobin level in the intact hemisphere ($p = 0.02$), which is a cytoprotective factor. It was revealed that the T0AM thyronamine analogue could control redox status in acute brain ischemia. Further experimental studies are needed to evaluate its neuroprotective potential.

Keywords: thyronamines; protonation; intramolecular dynamics; DFT calculations; ischemic stroke; oxidative stress; lipid peroxidation.

sciforum-105292: The Bee Product Royal Jelly Reduces Oxidative Stress in Healthy MRC-5 Cells and Upregulates *GSTP1* Expression

Milena M. Jovanović [1,*] and Dragana Šeklić [2]

[1] Department for biology and ecology, Faculty of Science, University of Kragujevac, Kragujevac, 34000, Serbia
[2] Institute for Information Technologies Kragujevac, Department of Natural Sciences, University of Kragujevac, Jovana Cvijića bb, 34 000 Kragujevac, Serbia

---

Redox homeostasis in the human body is strictly regulated by reducing molecules, such as glutathione, as well as various antioxidant enzymes. A correlation between oxidative stress damage and the majority of diseases has already been shown. Therefore, studying the antioxidant effects of natural products with prominent antioxidative properties is necessary for the prevention and treatment of various pathological conditions. RJ is a bee product known for its abundance in bioactive substances and its function as a very potent regulator of many metabolic processes. It is also considered a medicinal agent that can cope with oxidative stress. Being easy to access and produce, and due to its great antioxidant properties, RJ has become an ideal option for helping oncological patients that undergo chemotherapy, which can induce severe levels of oxidative stress in body.

This study aimed to evaluate RJ's ability to scavenge reactive species and modulate the GSTP1 marker in healthy cells in order to offer a scientific basis for the further development and use of this natural bee product.

Healthy lung fibroblasts (MRC-5 cell line) were treated with RJ at a concentration of 100 μg/mL, and after 24 h, the level of $O_2^{\bullet -}$ superoxide anion radicals was assessed by an NBT test, while the gene expression of the *GSTP1* marker was analyzed by the quantitative real-time polymerase chain reaction (qPCR) method.

This natural bee product reduced the concentration of $O_2^{\bullet -}$ in the tested cells within 24 h of treatment, and this antioxidative effect was most likely due to upregulated *GSTP1* expression. The protein product of the *GSTP1* gene is responsible for the catalyzation of glutathione (GSH) binding to oxidative stress metabolites, such as superoxide anion radicals, and their further neutralization in cells.

We found that RJ has an important protective effect against the oxidative damage of human lung fibroblast cells, and its properties can be used to explore new resources for pharmacological treatments, as well as to improve natural medicine.

sciforum-111765: The impact of 6-hydroxy-L-nicotine on inflammation in a 5xFAD mouse model of Alzheimer's disease

Alexandra-Mara Cimpanu *, Lucian Hritcu and Razvan Stefan Boiangiu

BioActive Research Group, Department of Biology, Alexandru Ioan Cuza University of Iasi, Romania

Introduction

Alzheimer's disease (AD) is a neurodegenerative disorder and the most common form of dementia. AD patients suffer from memory loss, aphasia, and personality and behavior changes and exhibit difficulties in thinking, language, and problem-solving skills. The main neuropathologic features of AD include extracellular plaques containing amyloid beta (Aβ) and intracellular neurofibrillary tangles of hyperphosphorylated tau protein. In addition to these essential features, several other pathologic changes such as inflammation and the sustained activation of microglia and other immune cells are commonly associated with AD. Nicotine has been reported to reduce anxiety and improve memory, learning, and attention, but its therapeutic use in AD is limited by its side effects. Here, we aim to evaluate the anti-inflammatory effect of a structure-related nicotine derivative, namely 6-hydroxy-L-nicotine (6HLN), in a transgenic mouse model of AD.

Methods

6HLN was chronically administered in doses of 0.3 and 0.6 mg/kg (b.w., i.p., for 30 days) to a 5xFAD mouse model of AD. By using ELISA, we measured the levels of glial fibrillary acidic protein (GFAP), nuclear factor kappa-light-chain-enhancer of activated B cells (NF-κB), interleukin 6 (IL-6), and tumor necrosis factor α (TNF-α) in the brains of the 6HLN-treated mice.

Results

Our results showed that 6HLN treatment reduced, in a dose-dependent manner, the levels of GFAP, NF-kB, IL-6, and TNF-α in the brain of the transgenic mouse model of AD, indicating a promising anti-inflammatory potential of 6HLN.

Conclusions

These findings are in accordance with those from the literature, indicating that 6HLN might represent a new neuropharmacological agent in ameliorating AD. This work was supported by CNCSIS-UEFISCSU, project number PN-III-P4-PCE-2021-1692.

sciforum-110598: Transcriptomic and Metagenomic Studies of *Eriodictyon crassifolium*

Savanah Senn [1,*], Xochitl Estrada [1], Steven Carrell [2], Ray A. Enke [3], Karu Smith [1] and Gerald Presley [4]

[1] Los Angeles Pierce College Department of Agriculture Sciences, Plant Science program, Woodland Hills, CA 91371, USA
[2] Oregon State University, Center for Quantitative Life Sciences, Corvallis, OR 97331, USA
[3] James Madison University, Biology Department, Harrisonburg, VA 22807, USA
[4] Oregon State University, Department of Wood Science and Engineering, Corvallis, OR 97331, USA

Studies of thick-leaf Yerba Santa have shown the presence of secondary metabolites useful in human health; sterubin and eriodictyol are produced by the plant. During May 2022, we sampled tissue and soil from a stand of *Eriodictyon crassifolium* leaf and fruit following a drought winter in the Gold Creek Preserve, Angeles National Forest. cDNA libraries were sequenced at BGIA; metagenomic sequencing was conducted by BGIA using DNBseq. DNA from rootzone soil samples was sent to JMU for sequencing using the Illumina MiSeq platform. The bioinformatics pipeline for RNAseq consisted of QC, de novo assembly, evaluation, quantification, and annotation. Our metabarcoding analysis used DNA Subway Purple Line, implementing QIIME and DADA2. Our metagenomic data analysis used Nephele BioBakery and analyzed the data with MicrobiomeDB and STAMP.

The BUSCO assessment indicated that the E. crassifolium transcriptome assembly was 94.88% complete. Discontiguous megaBLAST results revealed secondary metabolite candidate genes in related species that have antioxidant functions. The transcript for 4-coumarate ligase was 80.45% similar to *Arnebia euchroma*. The candidate gene for Trans-cinnamate-4-monooxygenase was 82.07% similar to *A. euchroma*. Delta-8-fatty acid desaturase was 77.59% similar to *Borago officinalis*. The annotations included antioxidant-related transcripts that were previously uncharacterized in *Boraginaceae*, *Namaceae*, or *Eriodictyon.* Among these were Chalcone synthase (92.031% similar to *Vitis)*, Tryptophan synthase beta chain 2 (94.551% similar to *Camptotheca)*, and Shikimate-O-hydroxycinnamoyl transferase (87.356% similar to *Nicotiana)*.

In Yerba Santa, there was an overlap between highly expressed genes involved in flavonoid and aromatic compound production and rhizosphere bacteria with genes for producing similar compounds. In the rootzone, there were increased *Pedobacter* and *Pseudomonas* reads identified within the 16S metabarcoding reads. According to the STAMP output, in the Yerba Santa rootzone, L-Tryptophan biosynthetic gene counts were elevated in the rootzone bacteria, along with Flavin biosynthesis I genes. Further studies should consider the cross-validation of elevated secondary metabolite genes with reference sequences from closely related species.

Session 6. Antioxidants Extraction, Assay and Industrial Applications

sciforum-111872: Anticancer potential of antioxidant extract from spent coffee grounds.

Adrianna Maria Piasek [1,2,*], Łukasz Wysocki [1,2] and Anna Sobiepanek [1]

[1] Warsaw University of Technology, Faculty of Chemistry, Chair of Drug and Cosmetic Biotechnology, Poland
[2] R&D Department, EcoBean sp. z o. o., Koszykowa 75, Warsaw, 00-662, Poland

---

Coffee is one of the most popular beverages in the world. Europe has the highest consumption of green coffee beans and generates about 3.4 million tons of spent coffee grounds (SCGs) every year. Despite the long and complex processing of coffee beans, SCGs still contain numerous valuable compounds, including antioxidants. These compounds have a beneficial influence on various aspects of human health and even anticancer activity. Cancer is one of the leading causes of death worldwide. The skin, as the largest organ of our body, is exposed to dangerous external factors such as UV, which has been defined as the main cause of skin cancers. This research aims to investigate the possible usage of a full antioxidant extract from SCGs, as well as single compounds like caffeine and chlorogenic acid. in anti-cancer therapies.

The antioxidant extract, caffeine and chlorogenic acid were obtained by way of an optimized extraction process. The influence of the obtained compounds and the entire extract on normal and cancer skin cell lines was checked. The effect on melanoma cells at various metastatic stages and on squamous-cell carcinoma was tested. The impact of the tested compounds was assessed using cytotoxicity tests such as FDA/PI, MTT and resazurin staining.

The impact of each tested extract, along with caffeine and chlorogenic acid, varied depending on the cell lines analyzed. Notably, differences were observed even among melanoma cells at distinct metastatic stages. For instance, the ethanolic extract demonstrated a suppressive effect on the metabolic activity of primary melanoma cells.

SCGs are a remarkable source of various antioxidants with possible applications in various fields. This study allows us to gain unique knowledge about the impact of the antioxidants contained in SCGs on normal and cancerous skin cells.

This work was supported by the National Science Centre (Poland) Grants no.2023/49/N/NZ5/03578.

sciforum-111887: Harnessing Antioxidant Potential: Optimized Extraction of Bioactive Compounds from Yellow Kiwi Peels (*Actinidia chinensis*)

Rafael Nogueira-Marques [1,*], F. Chamorro [1], A. Perez-Vazquez [1], A.O.S. Jorge [1,2], Aurora Silva [1,3] and M.A. Prieto [1]

[1] Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain.
[2] REQUIMTE/LAQV, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, R. Jorge Viterbo Ferreira 228, 4050-313 Porto, Portugal
[3] REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Rua Dr. António Bernardino de Almeida 431, 4249-015 Porto, Portugal.

With the increasing problem of food waste, research on agro-industrial by-products has proven to be an asset in the search for bioactive compounds with biological activities, such as antioxidant properties. The kiwi industry generates many by-products such as the peel, bringing the possibility of using these residues effectively, recovering target molecules and developing new products, including nutritional supplements, medicines and food additives. Optimization plays a crucial role in identifying the "best" conditions and potential interactions among the parameters involved in the extraction process to maximize desired outcomes. This process not only boosts the circular economy but also promotes consumer health. The main objective is to evaluate the phenolic acids present in the peel of the species *Actinidia chinensis* (yellow kiwifruit) as a potential source of antioxidants, through the optimization of the heat-assisted extraction (HAE) technique through the response surface model. In this study, the peel of *A. chinensis* was shown to be rich in phenolic acids, of which the predominant is dihydroferulic acid 4-O-glucuronide, with a content of 67.32 mg/g E, accompanied by significant amounts of quinic acid (23.15 mg/g E) and 5-5-dehydrodiferulic acid (4.08 mg/g E), all of them reported for their antioxidant power. The conditions that maximized HAE extraction of phenolic acids were 5 min, 30 ºC and 100% water. This suggests that the compounds degrade with time and high temperature and have a strong affinity for water. All significant parameters were highly consistent (p0.01) and the high R2 values also confirmed this hypothesis by indicating the percentage of variability calculated by the model. The high levels of these compounds in yellow kiwifruit waste underscore their potential for nutraceutical and industrial applications. Additionally, the antioxidant capabilities of these residues are directly linked to their phenolic acids content, suggesting that they could be effectively used in health-promoting products.

sciforum-111724: Sustainable Biopesticides from *Citrus* waste: innovative extraction methods for eco-friendly crop protection

Sefora Esposito *, Marika Avitabile, Loredana Mariniello, Daniele Naviglio, Lucia Panzella, Maria Laura Alfieri and Concetta Valeria Lucia Giosafatto

Department of Chemical Sciences, University of Naples Federico II, Italy

The increasing demand for sustainable agriculture underscores the need for eco-friendly alternatives to chemical pesticides. To address this issue, the European Union supports Integrated Pest Management (IPM), with a particular focus on biopesticides as safer, more sustainable options. Orange peels, a by-product of citrus processing, contain bioactive compounds with antimicrobial, antioxidant, and pesticidal properties [1]. However, these valuable compounds are often discarded, contributing to environmental pollution. Hence, this study investigates the recovery of active molecules (AMs) from citrus waste, specifically orange peels, to develop new biopesticides. A key aspect of this research is the development of an eco-friendly extraction method for AMs. Traditional methods like Soxhlet extraction are energy-intensive, use harmful chemicals, and generate waste. In contrast, the Naviglio extractor, a solid–liquid extraction technique, operates at room temperature and uses negative pressure to efficiently extract bioactive compounds while minimizing environmental and safety concerns, using different times of extraction (2 h, 22 h, 96 h) [2]. The results show that the extracts obtained with the Naviglio extraction method are endowed with higher antioxidant activity, as demonstrated by their greater total phenolic content (TPC) and radical-scavenging activity (RSA) compared to Soxhlet extraction [3]. UV-Vis and LC-MS analyses were performed to assess the chemical profiles of the extracts. The Naviglio extracts exhibited higher absorbance and distinctive peaks associated with carotenoids, confirming their presence. LC-MS analysis revealed that several compounds were present in the extracts, with their intensity decreasing as extraction time increased. Apigenin 7-O-glucoside, hexamethylquercetagetin, nobiletin, sinensetin, and tangeretin were identified as the main phenolic components. These findings suggest extraction time is a key factor influencing the composition and concentration of bioactive compounds in orange peel extracts. This research promotes a circular economy by utilising citrus waste, transforming waste into valuable resources.

References

1. Cirrincione F. et al. (2024) Food Res, Int, 187, 114422
2. Naviglio D. et al. (2003) Anal. Lett. 36,8, 1647–1659
3. Famiglietti M. et al. (2022) Foods 11(14), 2078

sciforum-114239: Bioactive Potential of *Lantana camara* Leaf Extracts: Phytochemical Composition, Antioxidant, Anti-Diabetic, and Antimicrobial Activities, and Molecular Docking analysis

Shiwa Chaubey [1], Nisheeth Rastogi [2] and Manjoosha Srivastava [1]

[1] Phytochemistry, CSIR - National Botanical Research Institute (NBRI), Phytochemistry Division, Lucknow, 226002, India.
[2] Department of Chemistry, Lucknow Christian Post-Graduate College, Lucknow 226018, Uttar Pradesh, India.

Lantana camara, which is used in Indian traditional medicine, was analysed to determine its phytochemicals and biological activities. The leaves were dried (250 g) and subjected to maceration and Soxhlet extraction techniques, employing solvents of increasing polarity. Chemical profiling was carried out using GC-MS, and the concentration of phenolics, flavonoids, alkaloids, and other bioactive compounds were determined using UV spectrophotometry. Preliminary phytochemical tests also indicated the existence of these compounds in considerable quantities, therefore recommending their utilization in treatments. Antioxidant activity was determined using **DPPH, FRAP, ABTS, phosphomolybdate, H_2O_2, $^{\bullet}OH$, nitric oxide,** and **Fe^{2+}-chelating** methods. The extracts had a relatively high antioxidant capacity, which decreased the oxidative damage at 50, 100, 150, 200, and 250 µg/mL. Antidiabetic activity was confirmed by testing for **α-amylase inhibition** using starch azure as a substrate. The inhibition profile was assessed at 595 nm, indicating that inhibition was dependent on the extract concentrations (10-100 µg/mL). The a**ntibacterial activity** of the extract was assessed using the agar well diffusion method, showing activity against *Escherichia coli*, *Bacillus subtilis, Staphylococcus aureus,* and *Klebsiella pneumonia*. The presence of **antifungal activity** against bacterial types such as *Candida albicans*, *Aspergillus niger*, *Aspergillus flavus*, and *Aspergillus fumigatus* showed that the plant has antifungal properties supported by its high-spectrum antimicrobial property. The **molecular docking** analytical results showed high-affinity interactions between the bioactive compound and the target protein, which further validated the plant's antioxidant and antimicrobial potential. Based on these outcomes, it seems that *Lantana camara* extracts have potential for utilization in the pharmaceutical and nutraceutical industries as natural antioxidants and antidiabetic and antimicrobial compounds. More research has to be carried out on their toxicity, medical uses, and other forms of extraction methods in order to increase efficacy and minimize toxicities.

sciforum-113275: Chloride tris[*N*-(prop-2-en-1-yl)hydrazinecarbothioamide]-cobalt(III) as a stimulator of the total antioxidant status of *Apis Mellifera*.

Olga Garbuz [1,*], Vasilii Graur [2], Victor Tsapkov [2], Nadejda Railean [1], Ion Toderas [1] and Aurelian Gulea [2]

[1] Laboratory of Systematics and Molecular Phylogenetics, Institute of Zoology, Moldova State University, 1 Academiei Street, MD-2028 Chisinau, Moldova
[2] Laboratory of Advanced Materials in Biopharmaceutics and Technics, Institute of Chemistry, Moldova State University, 60 Mateevici Street, MD-2009 Chisinau, Moldova

Oxidative stress is a major factor in the development of diseases in *Apis Mellifera*. To assess the functionality of the antioxidant system in bees, total antioxidant status (TAS) serves as a critical indicator. Commonly, Vitamin C is used to enhance TAS, yet its effectiveness is limited by its relatively low antioxidant activity. In this study, we synthesized tris[*N*-(prop-2-en-1-yl)hydrazinecarbothioamide]cobalt(III) chloride, offering a novel alternative to Vitamin C for TAS enhancement. Notably, previous research has not explored coordination compounds for this purpose in bees.

The cobalt(III) complex was synthesized through the reaction of cobalt(II) hexahydrate with *N*-(prop-2-en-1-yl)hydrazinecarbothioamide in ethanol and hydrochloric acid at 50-55°C, yielding an octahedral complex cation, where the neutral bidentate ligands facilitated the oxidation of cobalt(II) to cobalt(III) with 87% efficiency. The characterization techniques included single crystal X-ray diffraction, FT-IR, ^{1}H NMR, ^{13}C NMR, elemental analysis, and molar conductivity. Antioxidant activity was assessed via ABTS, DPPH, and ORAC assays, while toxicity was evaluated using *Daphnia magna*. The complex demonstrated significant antioxidant activity, with an IC_{50} of 7.3±0.3 μM, and lower toxicity than expected, with an LC_{50} of 56.3±3.1 μM.

The experimental results revealed that tris[*N*-(prop-2-en-1-yl)hydrazinecarbothioamide]cobalt(III) chloride increased TAS in the hemolymph of bees and larvae by up to 5 and 8 times, respectively. The IC_{50} values were recorded at 2.5 mg/mL for bee hemolymph and 1.3 mg/mL for larval hemolymph, compared to control values of 13.6 mg/mL and 10.0 mg/mL, respectively.

The stimulatory effect of the tested compound on TAS surpassed the activity of Vitamin C by up to 5 times.

These findings suggest that increasing TAS levels in bees could enhance their immune systems, highlighting the potential of tris[*N*-(prop-2-en-1-yl)hydrazinecarbothioamide]cobalt(III) chloride as a beneficial additive in apicultural health practices.

This research was funded by the subprograms 010602 and 010701.

sciforum-111901: Exploring the Role of Brown Algae as Scavengers of Reactive Oxygen and Nitrogen Species

Aurora Silva [1,2,*], Maria Carpena [2], Javier Echave [2], Clara Grosso [1], M. Fátima Barroso [1] and Miguel A Prieto [2,3]

[1] REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Rua Dr António Bernardino de Almeida 431, 4200-072 Porto, Portugal.
[2] Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain.
[3] Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolonia, 5300-253 Bragança, Portugal.

Oxidative stress, an imbalance between reactive oxygen species (ROS) and/or reactive nitrogen species (RNS) and the antioxidants present in the organism, has a significant role in the pathogenesis of various illnesses. Moreover, this process contributes to cellular damage, affecting DNA, proteins, and lipids, inducing cellular aging and age-related diseases such as cancer, cardiovascular diseases, and neurodegenerative disorders [1]. Brown macroalgae have been demonstrated to be significant potential ROS and RNS scavengers, primarily due to their rich antioxidant properties. Various studies have highlighted the ability of brown algae extracts to neutralize ROS and RNS, including superoxide ($O_2^{\bullet-}$) and hydroxyl ($^{\bullet}OH$) radicals, hydrogen peroxide (H_2O_2), and nitric oxide ($^{\bullet}NO$), which are known to contribute to oxidative stress. This antioxidant capability of these extracts is attributed to the presence of bioactive compounds such as polyphenols, specifically phlorotannins, among other secondary metabolites found in these marine species. In this work, six brown algae species, i.e., *Himanthalia elongata*, *Undaria pinnatifida*, *Sargassum muticum*, *Bifurcaria bifurcata*, *Fucus spira*lis, and *Ascophylum nodosum,* were studied, aiming to assess their ability to promote ROS and RNS scavenging. The bioactive compounds were extracted by microwave-assisted extraction [2–5], and the scavenging activity was tested by in vitro spectrophotometric methods [6]. The results showed that concerning the $^{\bullet}NO$ scavenging activity, the EC_{50} varied from 74 µg/mL to 2000 µg/mL for *Fucus spiralis* and *Himanthalia elongata*, respectively. The EC_{50} regarding the $O_2^{\bullet-}$ scavenging activity ranged from 16 µg/mL (Sargassum muticum) to 279 µg/mL (*Undaria pinnatifida*), while for H_2O_2 scavenging, the best result was achieved by *Fucus spiralis* (EC50 =39 µg/mL). The radical $^{\bullet}OH$ was the reactive species that required the highest quantity of algae extract to achieve the 50% depletion, averaging 1240 µg/mL. These results highlight the activity of the algae extracts as antioxidants, showing their potential to reduce oxidative stress.

sciforum-108008: Green synthesis, characterization, and evaluation of antioxidant properties of silver nanoparticles derived from marine brown algae *Padina sp.*

Ragavi Ratnaranjan * and Dinithi Peiris

Department of Zoology, University of Sri Jayewardenepura, Sri Lanka

Padina sp., an edible brown macroalgae found along Sri Lanka's coast, is known for its bioactive compounds, eco-friendliness, and therapeutic benefits. These compounds can reduce metal ions to form nanoparticles, acting as stabilizing and capping agents. Silver nanoparticles, renowned for their conductivity, stability, and disease-treating potential, were synthesized in this study using *Padina sp*. The objectives were to synthesize and characterize the nanoparticles and evaluate their antioxidant activity. Silver nanoparticles were synthesized by mixing crude methanol extract of *Padina sp.* with silver nitrate. Characterization was conducted using Ultraviolet–Visible (UV-Vis) spectroscopy, Dynamic Light Scattering (DLS), Zeta potential analysis, Scanning Electron Microscopy (SEM), Energy-Dispersive X-ray (EDX) analysis, X-ray Diffraction (XRD), Fourier-Transform Infrared (FTIR) spectroscopy, and Raman spectroscopy. Antioxidant activity was assessed using the 2,2-Diphenyl-1-picrylhydrazyl (DPPH) assay. Statistical data analysis was performed using Minitab, with the results expressed as the mean ± standard deviation (SD), and paired two-sample t-tests were used to assess significant differences (p 0.05). A visible color change from pale yellow to reddish-brown within 48 hours confirmed the formation of silver nanoparticles. UV-Vis spectroscopy showed a surface plasmon resonance peak at 420 nm, confirming the presence of nanoparticles. The DLS analysis revealed an average particle size of 73.19 nm, and the zeta potential obtained, -21.5 mV, indicated stability. The SEM images depicted spherical nanoparticles with smooth surfaces and no aggregation, while the EDX analysis confirmed 20% silver content by weight. The XRD analysis showed a face-centered cubic structure, indicating crystallinity. FTIR and Raman spectroscopy identified proteins, phenolic compounds, and amines as stabilizing agents, with polyphenolic compounds and flavonoids acting as reducing agents. In the DPPH assay, the antioxidant activity of silver nanoparticles (IC50 = 271.17 ± 3.99 μg/ml) was significantly higher than that of the crude *Padina sp.* extract (IC50 = 307.69 ± 9.33 μg/ml). These findings suggest that green-synthesized silver nanoparticles from *Padina sp.* offer a promising therapeutic strategy for diseases linked to oxidative stress.

sciforum-111696: A new era in plant extract antioxidant capacity optimization

Francisco Javier Alvarez-Martinez *, Edwina María Lazau, José Ramón Martínez-Guillén, Fernando Borrás-Rocher, María Herranz-López, Enrique Barrajón-Catalán and Vicente Micol Molina

Institute for Research, Development and Innovation in Health Biotechnology of Elche (IDiBE), Miguel Hernández University (UMH), 03202 Elche, Spain

Introduction

Plant extracts contain a wide variety of phytochemicals that provide valuable biological activities, notably antioxidant properties. Enhancing antioxidant capacity offers significant advantages for applications in healthcare, food, and cosmetics. The pursuit of process optimization has evolved with the advent of artificial intelligence (AI), offering unprecedented opportunities to obtain highly antioxidant extracts. In this study, AI-driven methodologies were applied to optimize antioxidant extraction from *Cistus salviifolius* while promoting more sustainable processes.

Methods

Optimization of aqueous *C. salviifolius* extracts was achieved using AIReviewer, a validated free AI-based tool for scientific literature analysis (https://doi.org/10.3390/antibiotics12020327), and a Python-coded Jupyter Notebook for data analysis and response surface methodology optimization via a Box—Behnken design. Antioxidant capacity was measured using TEAC and FRAP assays and total phenolic content by he Folin—Ciocalteu method. This optimization method is also compatible with the results of any antioxidant capacity quantification method including ORAC or DPPH, among others.

Results

AIReviewer literature analysis helped us to identify key extraction variables and their suitable ranges: time (0–240 min), temperature (25–50 °C), and ultrasonic energy (50–150 J/mL). Then, fifteen extractions were performed combining different variables using a Box—Behnken design. The optimal conditions (240 min, 25 °C, and 89.65 J/mL) predicted the maximum antioxidant capacity, yielding experimental results of 510.21 ± 24.69 mmol Trolox equivalents/100 g extract (TEAC) and 804.46 ± 22.11 mmol $FeSO_4$ equivalents/100 g extract (FRAP). The total phenolic content was 31.42 ± 1.45%, with a 30.11 ± 1.25% yield. These values surpass those reported in the literature, even for extracts obtained with non-aqueous solvents like ethanol.

Conclusions

AI-based optimization techniques effectively enhanced the antioxidant properties of *C. salviifolius* extracts, producing a phenolic-rich extract with superior antioxidant capacity. These methods also offer a more sustainable approach to extraction by significantly reducing the number of empirical trials needed to determine optimal conditions. The results demonstrate the value of AI in optimizing extraction processes, improving both the quality and sustainability of bioactive product development.

sciforum-111264: Agri-food industry by-products from the chestnut supply chain post-harvest: the potential of episperm as a source of antioxidant compounds for human well-being

Dario Donno [1,2,*], Federica Turrini [3,4], Emanuele Farinini [3], Maria Gabriella Mellano [1,2], Raffaella Boggia [3,5], Gabriele Loris Beccaro [1,2] and Giovanni Gamba [1,2]

[1] Department of Agricultural, Forest and Food Sciences. University of Turin. Grugliasco (TO), Italy
[2] Chestnut R&D Center – Piemonte. Chiusa di Pesio (CN), Italy
[3] Department of Pharmacy. University of Genoa. Genoa, Italy
[4] National Center for the Development of New Technologies in Agriculture (Agritech). Napoli, Italy
[5] National Biodiversity Future Center (NBFC). Palermo, Italy

In recent years, there has been a significant increase in the chestnut processing industry, leading to the generation of substantial amounts of by-products that are causing disposal challenges and environmental consequences within the post-harvest supply chain of *Castanea* spp. nuts. In particular, chestnut episperm, produced in large quantities during post-harvest processing, shows potential to serve as a valuable source for extracting antioxidant compounds, including phenolics. This study has developed an environmentally sustainable method for extracting the polyphenols and antioxidants with best health-promoting properties from chestnut episperm (cv Marsol, *C. sativa* × *C. crenata*) using ultrasound technology. High-performance liquid chromatography (HPLC) was used to assess the levels of specific phenolic compounds known for their health benefits and antioxidant capacity. The total polyphenolic content (TPC) ranged from 90 to 150 mg GAE/g of dried weight (DW). Furthermore, a Ferric Reducing Antioxidant Power (FRAP) assay confirmed the high TPC levels in the extract, showing that all the extracts presented high levels of antioxidant properties (approximately 470–515 mmol Fe^{2+}/Kg of dried weight for the most effective extracts). The proposed method enabled the production of preparations containing significant amounts of castalagin (20–80 mg/100 g DW), chlorogenic acid (15–25 mg/100 g DW), vescalagin (40–75 mg/100 g), and ferulic acid (80–120 mg/100 g DW). This investigation demonstrated the potential of chestnut episperm as an innovative source of antioxidants, which may be extracted using sustainable technologies and utilized in industry applications as pharmaceutical and/or food products, thereby promoting the valorization of agri-food waste through a low-impact reuse strategy and reducing environmental impacts. Chestnut companies stand to benefit financially by extracting antioxidant molecules through processing post-harvest wastes like episperm and marketing these preparations, thereby avoiding expenses associated with by-product disposal and potentially increasing their incomes.

sciforum-111859: Analysis of the antioxidant effect of macroalgae extracts using Fourier Transform Infrared spectroscopy and machine learning techniques

Pedro Sousa Sampaio [1,2,*], Igor Peres [3], Joaquim Pedro Silva [4] and Cecília Calado [3,5]

[1] COPELABS - Lusófona University
[2] GREEN-IT BioResources for Sustainability Unit Institute of Chemical and Biological Technology António Xavier, ITQB NOVA, Av. da República, 2780-157 Oeiras, Portugal
[3] ISEL-Instituto Superior de Engenharia de Lisboa, Instituto Politécnico de Lisboa, Rua Conselheiro Emídio Navarro, 1 1959-007 Lisbon, Portugal.
[4] BioRG-Bioengineering and Sustainability Research Group, Faculty of Engineering, Lusófona University, Campo Grande, 376, 1749-019 Lisbon, Portugal
[5] i4HB – The Associate Laboratory Institute for Health and Bioeconomy, iBB – Institute for Bioengineering and Biosciences, IST – Instituto Superior Técnico, Universidade de Lisboa, Lisbon, Portugal

Macroalgae are a great source of antioxidants, which show valuable pharmacological properties and benefit human health [1]. The growing interest in marine algae is driven by their plentiful natural bioactive compounds, with biological benefits such as antioxidative, anti-inflammatory, antimicrobial, anticancer, and cardioprotective properties [2], which hold promise for the food and pharmaceutical industries [3,4]. The macroalgae species *Fucus vesiculosus*, *Asparagopsis armata*, *Saccorhiza polyschides*, and *Stigeoclonium subsecundum* were studied. The *F. vesiculosus* species represents a rich source of compounds such as polyphenols, and one particular group of polyphenols found in these brown algae are phlorotannins, which have a wide range of biological activities such as antibacterial, antioxidant, anti-tumor, anti-inflammatory, and anti-allergic activities [5]. The extracts were evaluated concerning their antioxidant activity, phenol concentration and antimicrobial activity. The results of the total phenol and antioxidant assays showed that *Fucus vesiculosus* extracted with acetone and water had the highest content of both total phenols and antioxidants. Additionally, we also evaluated how the Fourier Transform Infrared Spectroscopy (FTIR) spectra of the extracts could be correlated with their antioxidant properties. The results of FTIR showed that some of the species at specific concentrations had very similar chemistry properties after the analysis of their spectra, with the results of Partial Least Squares (PLS) indicating good correlation between the solvent and extract variables. Based on different solvents, it is possible to improve the extraction of the most suitable antioxidant compounds and consequently to develop a faster and more efficient model for analyzing their respective biomolecular effects, as well as classification models associated with machine learning techniques to save time and resources.

sciforum-111759: Antimicrobial and Antioxidant Peptides from *Wickerhamomyces anomalus*: A Natural Solution for Clean Label Food Preservation and Beyond

Patrícia Branco [1,*], Ana Costa [2], Diogo Ventura [2] and Catarina Prista [2]

[1] BIORG—Bioengineering and Sustainability Research Group, Faculdade de Engenharia, Universidade Lusófona, Av. Campo Grande 376, 1749-024 Lisbon, Portugal
[2] Linking Landscape, Environment, Agriculture and Food (LEAF), Associated Laboratory TERRA, Instituto Superior de Agronomia, University of Lisbon, Tapada da Ajuda, 1349-017 Lisbon, Portugal

---

As the consumer demand for healthier foods free from chemical preservatives grows, the food industry faces increasing pressure to develop minimally processed, natural, "clean label" products [1]. One promising approach is the use of natural preservatives, such as bioactive metabolites produced by microorganisms. *Wickerhamomyces anomalus* is a yeast that produces extracellular peptides with biopreservative potential. Previous studies have demonstrated their effectiveness against the spoilage yeast *D. bruxellensis* and the reference strain *S. cerevisiae* DBPVG 6500 [2], positioning these peptides as a valuable tool for natural food preservation.

Therefore, this study evaluated the antimicrobial and antioxidant properties of peptides derived from *W. anomalus's* metabolism. The peptides were obtained by culturing *W. anomalus DBVPG 3003* in YEPD medium, followed by ultrafiltration to isolate a 2–10 kDa fraction. Antimicrobial assays demonstrated strong bactericidal activity against *Escherichia coli*, *Listeria monocytogenes*, and *Salmonella* sp. at 1 mg/mL, with CFU reductions of 4–5 orders of magnitude. At 0.5 mg/mL, bacteriostatic effects were observed against *L. monocytogenes* and *Salmonella* sp., while the yeast strains (*Candida albicans* and *C. krusei*) showed resistance at all of the tested concentrations.

Antioxidant activity, assessed using DPPH and FRAP assays, highlighted the peptides' substantial radical scavenging and ferric-reducing capabilities. At 1 mg/mL, the peptides achieved a DPPH inhibition of 1856 ± 37.5µM TE/mL and a FRAP value of 5843 ± 220µM TE/mL, demonstrating their strong antioxidant potential.

These results underscore the potential of *W. anomalus* peptides as natural preservatives for the food industry, enhancing safety, extending shelf life, and supporting the development of healthier "clean label" products. Beyond food applications, their antioxidant and antimicrobial properties also present opportunities in the pharmaceutical, cosmetic, and nutraceutical industries.

References

[1] Asioli, D., et al. (2017). https://doi.org/10.1016/j.foodres.2017.07.022
[2] Comitini, Fet al. (2004). https://doi.org/10.1111/j.1574-6968.2004.tb09761.x

sciforum-109323: Antioxidant Activity and Simultaneous Estimation of Phenolic Compounds in *Citrus medic*a Leaf Extracts Using Isocratic HPLC-PAD

Priyanka Uniyal *, Deepanmol Singh and Ravi Rawat

School of Health Sciences and Technology, University of Petroleum and Energy Studies, Dehradun, Uttarakhand, India.

Citrus medica, a member of the Rutaceae family, is renowned for its rich phytochemical profile and therapeutic potential. Its leaves, a less explored part of the plant, are abundant in phenolic compounds known for their antioxidant, antidiabetic, and cardiovascular benefits. This study aimed to extract, isolate, and characterize six phenolic compounds from *C. medica* leaves, including diosmin, naringenin, hesperidin, quercetin, naringin, and *p*-coumaric acid. Employing Soxhlet extraction with 80% ethanol, we optimized the isolation process to ensure maximal yield and purity.

The antioxidant activity of the ethanolic extract was assessed via DPPH (2,2-diphenyl-1-picrylhydrazyl) and hydrogen peroxide radical-scavenging assays. In the DPPH assay, the extract exhibited a maximum inhibition of 74.8%, while ascorbic acid, used as the standard, achieved 89.2% inhibition. Similarly, the hydrogen peroxide scavenging assay demonstrated 69.1% inhibition for the extract compared to 85.1% for ascorbic acid, highlighting its significant free radical-scavenging potential.

A novel isocratic high-performance liquid chromatography–photodiode array detection (HPLC-PAD) method was developed for the simultaneous quantification of the six phenolic compounds. This method demonstrated exceptional specificity, linearity, sensitivity (LOD and LOQ), precision, and accuracy. Unlike gradient-based approaches, this isocratic method offers simplicity, reproducibility, and compatibility with systems featuring isocratic pumps. It enables efficient analysis in a single run, addressing a significant gap in the literature, as previous methods primarily targeted fruits and peels while neglecting the phytochemical richness of leaves.

Validation confirmed the robustness and suitability of the method for industrial applications, ensuring high-quality phenolic profiling for the food, pharmaceutical, and nutraceutical sectors. The findings underscore the potential of Citrus leaves as a valuable source of bioactive compounds and the utility of the developed method for advancing plant-based analytical research.

sciforum-111683: Antioxidant activity in fruit and vegetable matrices from Argentine Patagonia: extraction, quantification, and comparative analysis with reference standards

Facundo Carlos Namor and Carolina Antonella Paulino *

Facultad de Ciencias y Tecnología de los Alimentos – Universidad Nacional del Comahue. Villa Regina, Río Negro

Many plant-derived compounds with high antioxidant activity are widely used in food applications. Among various methods for measuring antioxidant activity, such as FRAP, ORAC, ABTS, and ESR, DPPH (2,2-diphenyl-1-picrylhydrazyl) is the most commonly employed, despite the difficulties in comparing the results obtained with different DPPH concentrations across assays. To address this difficulty, Sherer and Godoy (2009) proposed using a new indicator, the Antioxidant Activity Index (AAI), calculated as the initial DPPH concentration divided by the EC50, accounting for the variation in the aforesaid DPPH concentration. In this study, we aimed to isolate and quantify antioxidant compounds from fruits and vegetables and compare them to known standards using the AAI index. For this purpose, extracts were prepared at 37°C using 1% HCl in ethanol. Samples were analyzed in triplicate, determining EC50 (ppm of dry sample needed to reduce the initial 50 ppm DPPH concentration by 50%) and calculating the Antioxidant Activity Index (AAI) as a ratio of the initial DPPH concentration to the EC50. AAI was assessed in extracts from various fruits, including grapes, apples, figs, peaches, plums, pears, and berries, along with standards such as gallic acid, ascorbic acid, ferulic acid, rutin, chlorogenic acid, and caffeic acid. Plums exhibited the highest AAI (1.06), followed by berries, with calafate (1.04) and maqui (0.96) standing out. Red grapes had an AAI of 0.59, apples and pears had lower values (0.33 and 0.29), and figs had the lowest (0.08). Standards showed significantly higher AAI values, ranging from 29.9 (gallic acid) to 6.23 (ferulic acid). These results suggest that these fruit and vegetable matrices could serve as sources of antioxidant compounds, adding value to local production and contributing to developing functional foods with health benefits beyond traditional nutritional requirements. Finally, we regard the usage of the AAI index as helpful when comparing results among assays and matrices.

sciforum-112978: Antioxidant activity of casein hydrolysates produced using *Bromelia serra* leaf extract

Melanie Desirée Gomez Herrera [1,*], Paula Alayón Luaces [2] and Maria VIctoria Avanza [3]

[1] National University of the Northeast (UNNE), National Scientific and Technical Research Council (CONICET)
[2] Department of Plant Production, National University of the Northeast (UNNE), Corrientes, 3400, Argentina.
[3] Roca Campus, Institute of basic and applied chemistry (IQUIBA NEA UNNE CONICET), National University of the Northeast (UNNE), Corrientes, 3400, Argentina.

In this study, hydrolysis tests were conducted on casein at different incubation times to assess the antioxidant activity of hydrolysates produced by *Bromelia serra* leaf extracts (BLEs). The hydrolysis reaction was carried out at 90, 120, and 240 minutes (treatments) at 55°C in an incubator with constant agitation at 300 rpm. The reaction was stopped by thermal shock (boiling above 100°C) for 15 minutes. The degree of hydrolysis (%DH) was determined using the Adler-Nissen TNBS method. The antioxidant capacity of a sample was measured based on its ability to neutralize the ABTS cation radical. The progression of the percentage of %DH over digestion time showed no significant differences between 90 and 180 minutes, with 5.68% and 6.91% DH, respectively. At 240 minutes of incubation, the highest DH value was obtained, at 12%. The antioxidant activity of the hydrolysates obtained from each treatment was measured. Dilutions of the hydrolysates from each treatment were also prepared to determine the percentage of inhibition as a function of protein concentration and to calculate the IC50 values. Antioxidant activity, expressed as TEAC (Trolox Equivalent Antioxidant Capacity), showed that casein exhibits antioxidant activity even without hydrolysis. Additionally, it was observed that the antioxidant activity of casein significantly decreased when exposed to hydrolysis at 55°C for 90 and 180 minutes with BLE. After 240 minutes of hydrolysis with BLE, its antioxidant activity significantly increased by approximately 18%. Regarding IC50, a similar trend was observed. The lowest IC50 value was obtained for the 240-minute hydrolysate, followed by unhydrolyzed casein. This indicates that 1.68 mg/mL of hydrolyzed casein (55°C for 240 minutes) is required to achieve 50% inhibition of the ABTS cation radical, compared to 1.98 mg/mL for unhydrolyzed casein.

sciforum-111978: Antioxidant Activity of Essential Oils: Focus on Portuguese Companies

Isabela dos Anjos [1,*], Caio Da Silva [2], Bruno Medronho [3] and Luis Alves [4]

[1] Laboratory of Plant Biotechnology. MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Faculdade de Ciências e Tecnologia, Universidade do Algarve, Campus de Gambelas, 8005-139
[2] Biochemistry undergraduate student, University of Algarve, Campus de Gambelas, 8005-139 Faro, Portugal
[3] MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Faculdade de Ciências e Tecnologia, Universidade do Algarve, Campus de Gambelas, 8005-139 Faro, Portugal
[4] University of Coimbra, CERES, Department of Chemical Engineering, Pólo II – R. Silvio Lima, 3030-790 Coimbra, Portugal

Essential oils are derived from aromatic plants and can be extracted from various parts, including flowers, leaves, bark, fruit, seeds, and other important parts of the plant. Historically, these oils have been utilized for their therapeutic properties and continue to be an integral part of folk medicine across diverse cultures, owing to their multifaceted and remarkable medicinal benefits, which encompass antioxidant, anti-inflammatory, analgesic, anti-cancer, liver-protective, and neuroprotective properties, among others. As part of the “Albread” project, supported by the Promove 2023 competition and titled “Aromatic plants from Alentejo, probiotics, and acorn flour in the development of functional bread”, this study aimed to investigate the antioxidant potential of essential oils marketed by companies in the Alentejo and Algarve regions of Portugal. A total of 21 essential oils were evaluated for their antioxidant capacity using two widely used methodologies: DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging and ABTS (2-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid)) radical scavenging assays. The solvent employed for diluting the essential oils in this study was 70% ethanol, with Trolox serving as the standard, and all tests were conducted in triplicate. The results indicated a successful differentiation of the antioxidant potential of the essential oils across both methodologies. The DPPH method revealed antioxidant activity ranging from 0.039 to 0.518 mgTE/gEOW, while the ABTS method demonstrated a range of 0.21 to 3.08 mgTE/gEOW. It can be concluded that the 21 essential oils assessed from Portuguese companies exhibited variability in their antioxidant potential but maintained comparable patterns between the DPPH and ABTS methods. Essential oils 11, 12, and 13 exhibited the highest antioxidant activity, whereas oil 7 demonstrated the lowest potential.

sciforum-111762: Antioxidant and anti-inflammatory actions of red seaweed (*Grateloupia turuturu* and *Porphyra umbilicalis*) extracts linked to phytochemical characterization and cytotoxicity evaluation

João Ferreira [1,*], Carlos Martins-Gomes [1], Anja Hartmann [2], Mário Pacheco [3], Isabel Gaivão [4] and Amélia M. Silva [1]

[1] Centre for Research and Technology of Agro-Environmental and Biological Sciences (CITAB), University of Trás-os-Montes and Alto Douro (UTAD), Quinta de Prados, 5000-801 Vila Real, Portugal
[2] Institute of Pharmacy, Department of Pharmacognosy, University of Innsbruck, Innrain 80-82, 6020 Innsbruck, Austria
[3] Centre for Environmental and Marine Studies (CESAM) and Department of Biology, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal
[4] Animal and Veterinary Research Centre (CECAV), UTAD, Quinta de Prados, 5000-801 Vila Real, Portugal

Seaweeds are recognized as valuable sources of nutrition. Among them, the red seaweeds *Grateloupia turuturu* and *Porphyra umbilicalis* are particularly noteworthy, commonly consumed as food in East Asia, and known for their unique bioactive compounds. Nonetheless, knowledge gaps remain in studies on their phytochemical composition and bioactivities. Hence, *G. turuturu* and *P. umbilicalis* hydroethanolic and aqueous (infusion and decoction) extracts were prepared to first characterize their reducing compounds. Then, the cytotoxicity of the seaweed extracts was evaluated in RAW 264.7 cells. Antioxidant activity was then assessed in three biochemical assays ($ABTS^{\bullet+}$, $^{\bullet}OH$ and $^{\bullet}NO$ radical), and anti-inflammatory potential was measured in RAW 264.7 cells. Folin—Ciocalteau results showed a higher content in reducing compounds for aqueous extracts compared to hydroethanolic extracts for both seaweeds. RP-HPLC-DAD/LC-DAD-ESI-MS analyses showed the presence of myscoporine-like amino acids (MAAs), but not phenolics. *P. umbilicalis* had a higher MAA content than *G. turuturu* across all extracts, with porphyra-334 being the most concentrated MAA in *P. umbilicalis* and shinorine in *G. turuturu*. The highest carbohydrate content (39% extract) was shown by *P. umbilicalis* decoction. For cytotoxicity upon 24h exposure, a *P. umbilicalis* infusion extract had an IC_{50} of 0.43 mg/mL, while other extracts showed IC_{50} values above 0.75 mg/mL. *G. turuturu* and *P. umbilicalis* decoction extracts showed the highest $ABTS^{\bullet+}$ scavenging, at 70 and 97 mmol TE/g extract, respectively. *G. turuturu* water extracts produced the highest scavenging against $^{\bullet}NO$, 54-56%, while both hydroethanolic extracts exhibited the highest $^{\bullet}OH$ scavenging (55%). All seaweed extracts inhibited NO production/release in lipopolysaccharide-induced cells, with the highest anti-inflammatory activity shown in *P. umbilicalis* hydroethanolic extract, reducing NO levels to 41%. MAAs and carbohydrates are believed to be the main compounds accountable for the bioactivities. Thus, *G. turuturu* and *P. umbilicalis* reinforced their potential as nutraceuticals and sources of bioactive compounds.

sciforum-110951: Antioxidant and anti‑arthritic potential of *Micrococca mercurialis* (L.) Benth.

Mohan Ganpatrao Kalaskar

Department of Pharmacognosy, R.C. Patel Institute of Pharmaceutical Education and Research, Shirpur, Dhule, 425405, India

Chronic inflammation, particularly in arthritis, affects millions worldwide, leading to pain, reduced mobility, and diminished quality of life. Conventional therapies such as NSAIDs, corticosteroids, and biologics provide symptomatic relief, but are associated with adverse effects like gastrointestinal issues, cardiovascular risks, and increased susceptibility to infections. This highlights the need for safer, alternative therapeutic strategies. Plant-based therapies have gained attention due to their potential antioxidant and anti-inflammatory properties. In this context, the present study investigated the antioxidant and anti-arthritic potential of *Micrococca mercurialis* stem (MMS) extract. Bioactive compounds, including total phenolics (TPC) and flavonoids (TFC), were quantified using standard assays. Their antioxidant capacity was evaluated through DPPH, ABTS, and total antioxidant capacity assays. Anti-arthritic efficacy was assessed in a Complete Freund's Adjuvant (CFA)-induced arthritis model in rats. MMS extract was administered at doses of 200 and 400 mg/kg and compared with the standard drug, indomethacin. A methanolic extract of MMS showed significant bioactive content, with TPC and TFC values of 112.12 ± 4.47 mg GAE/g and 12.54 ± 0.52 mg QE/g, respectively. The ABTS radical scavenging activity (IC_{50} = 62.85 ± 2.25 µg/mL) was stronger than DPPH activity (88.16 ± 2.01 µg/mL) and comparable to gallic acid. In the anti-arthritic model, MMS extract exhibited dose-dependent effects. The 400 mg/kg dose showed comparable efficacy to indomethacin (10 mg/kg) at all time points (days 4, 8, 14, and 21), with significant paw volume reduction (p 0.001). Hematological parameters such as RBC, WBC, Hb, and ESR, elevated due to inflammation, were normalized in the high-dose group. The methanol extract of *Micrococca mercurialis* stem demonstrated potent anti-inflammatory and antioxidant activities, suggesting its potential as a source of novel therapeutic agents for inflammatory conditions.

sciforum-110551: Antioxidant capacity of different *Fumaria officinalis* extracts

Rabiea Ashowen Ahmoda [1], Andrea Pirković [2], Violeta Milutinović [3], Dragana Dekanski [2], Aleksandar Marinković [4] and Aleksandra A. Jovanović [2,*]

[1] University of Belgrade, Faculty of Technology and Metallurgy, Karnegijeva 4, 11000 Belgrade, Serbia
[2] Institute for the Application of Nuclear Energy INEP, University of Belgrade, Banatska 31b, 11080 Belgrade, Serbia
[3] University of Belgrade, Faculty of Pharmacy, Vojvode Stepe 450, 11000 Belgrade, Serbia
[4] Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11000 Belgrade, Serbia

Polyphenols are a large group of secondary plant metabolites that can be employed as preservatives, antioxidants, and additives. *Fumaria officinalis* L. (fumitory, Fumariaceae family) is an annual scramblingplant, disturbed and cultivated throughout Europe, and several studies have shown its antimicrobial, antioxidant, antispasmodic, laxative, anthelmintic, anticoagulant, cholagogue, cytotoxic, and sedative potential. The present research aimed to extract antioxidants from the fumitory aerial part of the plant by performing traditional and novel extraction procedures (maceration and ultrasound- and microwave-assisted extractions, UAE and MAE, respectively) and determine the antioxidant capacity of the obtained extracts (ABTS, DPPH, CUPRAC, and FRAP assays). Fumitory macerate showed significantly lower ABTS radical scavenging activity, expressed as a higher IC_{50} value (the concentration of extract required to neutralize 50% of radicals, 11.4±0.1 mg/mL), in comparison to the other two extracts, whose IC_{50} values varied over a narrow range (8.6-9.5 mg/mL). However, in the DPPH assay, the trend was different: MAE (11.4±0.3 mg/mL)≥UAE (12.0±0.8 mg/mL)≥macerate (12.8±0.1 mg/mL). In the CUPRAC assay, the trend was as follows: UAE and MAE (17.84±0.85 and 18.05±0.71 µmol Trolox equivalent (TE)/g, respectively)>macerate (16.43±0.45 µmol TE/g). Regarding the results of the FRAP method, there was no statistically significant difference in terms of ferric ion reduction between the macerate, UAE, and MAE extracts (3.00-3.27 µmol Fe^{2+}/g). An LC-MS analysis of the fumitory extracts revealed the presence of protopine-type (protopine, oxo-, methyl and/or acetyl protopine derivatives and cryptopine) and spirobenzylisoquinoline-type alkaloids (fumariline and fumarophycine). Chlorogenic and caffeoylmalic acids were also identified, as well as quercetin trihexoside, rutin, methylquercetin pentoside hexoside, isoquercitrin, quercetin, and kaempferol deoxyhexosylhexoside. The presence or absence of significant differences among the fumitory extracts that show the highest antioxidant potential in the various employed tests can be explained by the fact that different secondary metabolites, and their interactions, can significantly affect the overall antioxidant activity of fumitory extracts.

sciforum-110648: Antioxidant potential of ergosterol–phospholipid liposomes with *Thymus serpyllum* extract

Dragana Dekanski [1,*], Andrea Pirković [1], Diana Lupulović [1], Predrag Petrović [2] and Aleksandra A. Jovanović [1]

[1] Institute for the Application of Nuclear Energy INEP, University of Belgrade, Banatska 31b, 11080 Belgrade, Serbia
[2] Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11000 Belgrade, Serbia

Thymus serpyllum extracts express antioxidative, antispasmodic, anti-inflammatory, antihypertensive, cytotoxic, antiseptic, antibacterial, and antifungal activities due to the presence of polyphenols. Polyphenol compounds from *T. serpyllum* extracts are sensitive to temperature, light, oxidation, and pH changes, possess low bioavailability, and have a bitter taste. Thus, despite their great bioactive potential, their application in different industries is quite limited. Liposomes can enhance the stability of encapsulated sensitive compounds and the bioavailability of poorly hydrosoluble components. Additionally, liposomal particles have outstanding biodegradability and a strong affinity for cells. Furthermore, the bilayer membrane of liposomes and its permeability can be modified by adding sterols, such as ergosterol, which can change the end product's properties and pharmacological behavior. Thus, the antioxidant activity of ergosterol–phospholipid liposomes with encapsulated *T. serpyllum* ethanol extract was examined. The DPPH and ABTS radical scavenging activity and ferric ion-reducing potential of the extract-loaded liposomes with different proportions of ergosterol (10 and 20 mol %) were investigated. The percentage neutralization of DPPH radicals for the samples with 10 and 20 mol % of ergosterol was 56.3±2.2% and 53.1±3.5%, respectively. The elimination of ABTS radicals was significantly higher and amounted to 95.3±2.6% (10 mol % of ergosterol) and 98.2±1.7% (20 mol % of ergosterol). The Fe^{3+}-reducing potential of the liposomes was 0.14±0.01 mmol FeSO4/L and 0.15±0.03 mmol $FeSO_4$/L (for 10 and 20 mol % of ergosterol, respectively). Therefore, there was no significant difference between the antioxidant capacity of the liposomes with differing amounts of ergosterol. Using LC/DAD/MS analysis, the polyphenol compounds identified in the encapsulated extract included chlorogenic, caffeic, rosmarinic, and salvianolic acids, salvianolic acid K isomer, 6,8-Di-C-glucosylapigenin, 6-hydroxyluteolin 7-O-glucoside, luteolin 7-O-glucuronide, and apigenin glucuronide. The antioxidant potential demonstrated in this study highlights the potential applications of liposomes prepared with ergosterol and active compounds of *T. serpyllum* extract in functional foods, pharmaceutics, or cosmetics.

sciforum-113693: Antioxidant properties of individual and combined extracts of honey and mint

Yuva Bellik [1,*] and Ammar Sidi Mohammed Selles [2]

[1] Department of Biological Sciences, Faculty of Life and Natural Sciences and of Earth and Universe Sciences, Mohamed El Bachir El Ibrahimi University, Bordj Bou Arreridj, 34000, Algeria.
[2] Laboratory of Research on Local Animal Products, Veterinary Sciences Institute, University of Tiaret, 14000, Tiaret, Algeria

Plant-based substances have been used in traditional medicine systems around the world. Plant materials with high contents of polyphenol and flavonoid compounds possess many biological and pharmacological properties. Many formulations based on polyphenols have been prepared in specific ratios and used for multiple purposes. The aim of the present study is to assess the level of bioactive compounds and antioxidant activity of individual extracts of mint (*Mentha spicata*) and honey and their combination. The total phenolic content (TPC) and the total flavonoid content (TFC) were determined spectrophotometrically. The antioxidant activity was assessed using different in vitro assays, including DPPH, ABTS, reducing power, and iron-chelation tests. According to the results, mint extracts exhibited the highest TPC (35.47 ± 0.08 mg GAE/g and 15.5 ± 0.06 mg GAE/g) and the highest TFC (32.03 ± 0.47 QE/g and 27.49 ± 0.32mg QE/g) compared to honey samples (0.35 ± 0.01 mg GAE/g and 0.32 ± 0.01 mg GAE/g for TPC and 0.23 ± 0.00 QE/g and 0.12 ± 0.01 QE/g for TFC). Both individual mint and honey extracts exhibited antioxidant activity. When combined, the honey--mint extracts demonstrated enhanced antioxidant activity compared to the individual extracts. The synergistic effect was particularly evident in the reducing power, DPPH, and ABTS assays. Meanwhile, honey--mint extracts showed low iron-chelating activity. This study provides scientific evidence supporting the traditional use of mint and honey together. The combined extract of mint and honey exhibited superior antioxidant activity compared to individual extracts, indicating that this combination may offer additional health benefits. Further research is needed to explore the potential applications of honey--mint mixtures as functional food additives or nutraceuticals.

sciforum-111783: Antioxidants and Coffee Oil from Spent Coffee Grounds as Potential Cosmetic Ingredients

Zoja Trojan [1,2,*], Adrianna Maria Piasek [1,2], Łukasz Wysocki [1,2] and Anna Sobiepanek [1]

[1] Warsaw University of Technology, Faculty of Chemistry, Chair of Drug and Cosmetic Biotechnology, Poland
[2] R&D Department, EcoBean sp. z o. o., Koszykowa 75, Warsaw, 00-662, Poland

Introduction

Around 10 million tons of coffee beans are consumed annually worldwide, resulting in the production of 6-8 million tons of spent coffee grounds (SCGs) [1,2]. Most of this waste is discarded in landfills, causing a threat to the environment [3]. Despite the brewing process, SCGs contain many valuable ingredients, such as lipids and antioxidants, which can be extracted as coffee oil and antioxidant extracts. Due to their antioxidant activity, those products are believed to have a positive effect on the skin and could find applications in the cosmetic industry. This study aimed to assess the feasibility of using these SCG-derived products as active ingredients in cosmetic emulsions.

Methods

O/W emulsions containing different concentrations of coffee oil and aqueous and ethanol antioxidant extracts were prepared by a hot-process emulsification technique. The antioxidant properties of the oil and antioxidant extracts after heating to emulsification temperature were measured via CUPRAC assay. The physical stability of emulsions was tested using the accelerated aging method. Emulsion cytotoxicity assessment was carried out on a 2D culture of keratinocytes from the HaCaT cell line. Cell viability was assessed using FDA/PI, MTT and resazurin assays.

Results

Heating coffee oil and antioxidant extracts did not lower their antioxidant activity. The addition of SCG-derived products to cosmetics did not affect their physical stability in an accelerated aging test. Emulsions containing different concentrations of coffee oil or antioxidant extract did not show a significant cytotoxic effect on HaCaT cells cultured in a monolayer.

Conclusions

Spent coffee grounds are a valuable source of antioxidants and coffee oil with potential use in the cosmetic industry. The studied SCG-derived products could find application as active and base ingredients in cosmetic emulsions such as face or hand creams.

sciforum-114878: Application of Biohydrogels Containing Adaptogens in Innovative Chronic Wound Therapy

Zuzanna Stępińska [1,*], Katarzyna Sala [1], Dominika Wanat [2], Magdalena Bańkosz [1], Magdalena Kędzierska [3] and Bozena Tyliszczak [1]

[1] Cracow University of Technology, Faculty of Materials Engineering and Physics, Department of Material Engineering, Cracow, Poland
[2] Cracow University of Technology, CUT Doctoral School, Faculty of Materials Engineering and Physics Department of Material Engineering, Cracow, Poland
[3] Department of Chemotherapy, Medical University of Lodz, WWCOiT Copernicus Hospital

---

The development of biocomposites for regenerative medicine focuses on combining natural and synthetic components to create materials with enhanced bioactivity and functionality. This project explores biocomposites based on poly(vinyl alcohol) (PVA) and bioactive plant extracts from *Centella asiatica* (Gotu Kola) and *Potentilla erecta* (Rhizome of Tormentil). These materials aim to promote tissue regeneration and accelerate wound healing.

The chemical composition of Gotu Kola and Rhizome of Tormentil extracts was analyzed using high-performance liquid chromatography (HPLC) and spectroscopic methods to identify active compounds such as asiaticoside and catechins. PVA was used as the primary polymer matrix, modified with plant extracts to enhance bioactivity. The biocomposites were synthesized through a solvent casting method, followed by cross-linking to improve mechanical stability. Characterization included swelling behavior, mechanical strength, antioxidant activity, and biocompatibility.

The biocomposites exhibited excellent mechanical properties and controlled swelling behavior, making them suitable for regenerative medicine. The incorporation of Gotu Kola extract significantly improved antioxidant and wound-healing properties, while the Rhizome of Tormentil extract contributed anti-inflammatory and antimicrobial effects. Biocompatibility tests showed that the materials support cell attachment and proliferation, confirming their potential for tissue engineering applications.

The project is financed with funds from the state budget granted by the Minister of Science within the framework of the "Student Scientific Clubs Create Innovations" (SKN/SP/601893/2024) "Application of Biohydrogels Containing Adaptogens in Innovative Chronic Wound Therapy". The research work was carried out within the SMART-MAT Functional Materials Science Club (section Smart-Mat) at the Faculty of Materials Engineering and Physics of the Cracow University of Technology.

sciforum-114032: Bioactive Potential of Cassia angustifolia Leaf Extract: Antioxidant and Antimicrobial Properties

Mohan Tiwari [1,*] and Shiwa chaubey [2]

[1] School of Studies in Biochemistry, Jiwaji University, Gwalior - 474011,India
[2] University of Lucknow; Lucknow 226007, Uttar Pradesh, India

Cassia angustifolia, a plant which has been extensively used in traditional medicine, was explored for its total antioxidant and total antimicrobial activities. The leaf extract was prepared using maceration and the Soxhlet extraction method with hexane, chloroform, ethyl acetate, and methanol solvents, which are non-polar and polar solvents, respectively. In the present study, DPPH, ABTS, and FRAP assays at 20, 40, 60, 80, 100, 150, and 200 μg/mL concentrations exhibited a substantial free radical-scavenging activity in terms of the calculated IC_{50} values. The extract was further tested against four bacterial pathogenic species, namely, Escherichia coli, Bacillus subtilis, Staphylococcus aureus, and Klebsiella pneumoniae, using the agar well diffusion method, resulting in impressive proved zones of inhibition. The extract's antifungal effect was evaluated against Candida albicans, Aspergillus niger, Aspergillus flavus, and Aspergillus fumigatus, and the extract showed great inhibition of fungal growth, indicating that the plant has high-spectrum antimicrobial activity. This study shows that C. angustifolia leaf extract has very high antioxidant potential activity, thus helping to combat oxidative stress. It also has the potential for broad-spectrum antimicrobial activity. Our results also suggest that the extract could be useful in the pharmaceutical, agricultural, food, and cosmetic industries, as the findings point to the fact that it is a natural source of antioxidant and antimicrobial substances. To establish and define its therapeutic use and identify its active compounds, more research is required in the future. Our findings will aid in future medicine and drug discovery, as well as in the exploration of the casia species and their medicinal properties.

sciforum-114877: Biocomposites for Regenerative Medicine Applications

Aleksandra Pietrzyk [1,*], Claudia Garbowska [1], Dominika Wanat [2], Magdalena Bańkosz [2], Magdalena Kędzierska [3] and Bozena Tyliszczak [1]

[1] Cracow University of Technology, Faculty of Materials Engineering and Physics, Department of Material Engineering, Cracow, Poland
[2] Cracow University of Technology, CUT Doctoral School, Faculty of Materials Engineering and Physics Department of Material Engineering, Cracow, Poland
[3] Department of Chemotherapy, Medical University of Lodz, WWCOiT Copernicus Hospital

Introduction

The development of biocomposites for regenerative medicine focuses on combining natural and synthetic components to create materials with enhanced bioactivity and functionality. This project explores biocomposites based on poly(vinyl alcohol) (PVA) and bioactive plant extracts from *Centella asiatica* (Gotu Kola) and *Potentilla erecta* (Rhizome of Tormentil). These materials aim to promote tissue regeneration and accelerate wound healing.

Methods

The chemical composition of Gotu Kola and Rhizome of Tormentil extracts was analyzed using high-performance liquid chromatography (HPLC) and spectroscopic methods to identify active compounds such as asiaticoside and catechins. PVA was used as the primary polymer matrix, modified with plant extracts to enhance bioactivity. The biocomposites were synthesized through a solvent casting method, followed by cross-linking to improve mechanical stability. Characterization included swelling behavior, mechanical strength and antioxidant activity.

Results

The biocomposites exhibited excellent mechanical properties and controlled swelling behavior, making them suitable for regenerative medicine. The incorporation of Gotu Kola extract significantly improved antioxidant and wound-healing properties, while the Rhizome of Tormentil extract contributed anti-inflammatory and antimicrobial effects. Biocompatibility tests showed that the materials support cell attachment and proliferation, confirming their potential for tissue engineering applications.

Conclusions

The proposed biocomposites demonstrate a promising approach to regenerative medicine, offering a combination of mechanical robustness, bioactivity, and biocompatibility. Future studies will focus on in vivo evaluations and further optimization of extract concentrations to tailor the biocomposites for specific clinical applications.

Acknowledgments: This research was carried out within the SMART-MAT Functional Materials Scientific Club of the Faculty of Materials Engineering and Physics at Cracow University of Technology and as part of the project entitled " Biocomposites for Regenerative Medicine Applications" financed by the FutureLab organization operating at Cracow University of Technology.

sciforum-111785: Brewers' Spent Grain Flour: Antioxidant Properties and Applications

Elisabete Muchagato Maurício [1,2,*], Patrícia Branco [1], Tiago Monteiro [1], Catarina Roma Rodrigues [1], Marisa Nicolai [1], Maria Lídia Palma [2], Paula Pereira [2,3,4], Joaquim Silva [1], Pedro C.B. Fernandes [1,5,6], Adília Charmier [1] and Manuela Lageiro [7,8]

1 BIORG—Bioengineering and Sustainability Research Group, Faculdade de Engenharia, Universidade Lusófona, Av. Campo Grande 376, 1749-024 Lisbon, Portugal
2 CBIOS—Research Center for Biosciences & Health Technologies, Universidade Lusófona, Campo Grande 376, 1749-024 Lisbon, Portugal
3 EPCV, School of Phycology and Life Science, Department of Live Sciences, Universidade Lusófona, Campo Grande 376, 1749-024 Lisboa, Portugal
4 CERENA—Center for Natural Resources and Environment, Instituto Superior Técnico (IST), Universidade de Lisboa, Av. Rovisco Pais, 1049-001 Lisboa, Portugal
5 iBB —Institute for Bioengineering and Biosciences, Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais, 1049-001 Lisbon, Portugal
6 Associate Laboratory i4HB—Institute for Health and Bioeconomy at Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais, 1049-001, Lisboa, Portugal
7 INIAV—Instituto Nacional de Investigação Agrária e Veterinária, Unidade de Tecnologia e Inovação, 2780-157 Oeiras, Portugal
8 GeoBioTec, GeoBioSciences, GeoTechnologies and GeoEngineering — NOVA FCT, NOVA University, NOVA School of Science and Technology, 2829-516 Caparica, Portugal

---

Beer is a widely consumed carbonated beverage produced using natural ingredients such as malted cereals, hops, yeast, and water.[1] During the brewing process, large quantities of Brewers' Spent Grain (BSG), derived from barley malt, represent the residue left after wort extraction and before fermentation. Traditionally regarded as waste, BSG has primarily been used for applications such as animal feed, organic fertiliser, or brick production[2].

This study aims to evaluate the development of flour from BSG and assess its antioxidant properties to determine its functional benefits as a strategy to valorise this by-product, with potential applications in the food and nutraceutical industries. BSG samples were collected from the brewery Crafters (Sintra, Portugal) after the brewing process. The collected BSG was refrigerated and then dried in an oven with forced air circulation at 50°C, milled into flour, and sieved through a 400 µm mesh. The flour was subsequently packed, sealed in polyethylene bags to prevent exposure to oxygen, and stored at -20°C, away from light, until analysis. The antioxidant activity of the resulting BSG flour was evaluated using the DPPH radical scavenging assay and the ferric reducing antioxidant power (FRAP) method. The flour was analysed for total flavonoid and phenolic contents using the Folin–Ciocalteu method. The results showed that BSG flour has an antioxidant activity of 2.12 ± 0.37 µmol TE/g flour for the FRAP assay and 1.69 ± 0.16 µmol TE/g flour for the DPPH assay, with significant levels of total phenolics (1.27 ± 0.03 mg GAE/g flour) and flavonoids (3.05 ± 0.54 mg QE/g flour). These results highlight the potential of BSG as a valuable source of natural polyphenolic compounds. The developed flour could be used as an eco-friendly antioxidant ingredient with applications in the food and nutraceutical industries, improving product preservation and functional properties.

References

1. Senna Costa, F. et al. (2021). DOI: 10.1007/s12649-020-01163-6
2. Chetrariu, A., Dabija, A. (2023). DOI: 10.3390/foods12071533

sciforum-111721: Chitosan-Based Microspheres as Antioxidant Carriers: A Sustainable Approach for Advanced Cosmetic Formulations

Celia Mei Moreno González [1,*], Pedro Valenctín Badía Hernández [1], Paula de Juan Maciá [1], Mary Cano Sarabia [2], Sofía Garro Villegas [3], Ricardo Mallavia Marín [1] and María Herránz López [1]

[1] Institute of Research, Development and Innovation in Healthcare Biotechnology of Elche (IDiBE), Miguel Hernández University (UMH), 03202 Elche, Spain
[2] Catalan Institute of Nanoscience and Nanotechnology (ICN2) CSIC and The Barcelona Institute of Science and Technology Campus UAB, Bellaterra, Barcelona 08193, Spain
[3] Tebrio insect industry leaders, 37120 Doñinos de Salamanca, Spain

Chitosan, a biopolymer derived from chitin, has garnered significant interest in the cosmetic industry due to its biocompatibility, biodegradability, and photoprotective properties. These features make it a key ingredient for developing innovative products that not only enhance cosmetic functionality but also address the growing demand for sustainability by reducing our reliance on fossil-based resources. In this context, the present study investigates the use of chitosan in the encapsulation of antioxidants through microspheres designed to optimize the stability, bioactivity, and efficacy of antioxidant compounds against oxidative stress.

Microspheres were synthesized using advanced techniques such as spray drying, ensuring high reproducibility and adherence to sustainability standards. The microspheres were characterized through spectroscopy and thermal and chemical stability assays, confirming their capacity to protect the encapsulated active compounds. Subsequently, the microspheres were incorporated into cosmetic formulations containing at least 95% natural ingredients, aligning with current ecological cosmetic regulations. In vitro assays on human keratinocyte and fibroblast models were performed to evaluate the safety, stability, and antioxidant efficacy of these formulations.

The characterization of chitosan was optimized to evaluate its physicochemical properties, such as molecular weight, degree of deacetylation, and density, which are critical for its encapsulation efficiency and functionality in cosmetic formulations. After this, the results indicated that certain chitosan-based microspheres functioned as effective physical filters in keratinocytes, providing relevant photoprotective properties. In fibroblasts, the microspheres demonstrated an ability to mitigate UVA-induced cellular damage and reduce the generation of reactive oxygen species (ROS), a key marker of oxidative stress. These findings highlight the potential of chitosan not only as an encapsulating material but also as a multifunctional ingredient in advanced cosmetic formulations. Its ability to combine sustainability with innovation positions it as a promising solution for a constantly evolving cosmetic sector, addressing consumer demands and environmental regulations.

sciforum-111647: Circular economy and valorization of pomegranate peel: Innovation for multifunctional applications

Nerea Pons-Rocamora [1,*], Franciso Javier Álvarez-Martínez [1] and Vicente Micol [2]

[1] Instituto de Investigación, Desarrollo e Innovación en Biotecnología Sanitaria de Elche (IDiBE), Universidad Miguel Hernández (UMH), 03202 Elche, Spain.
[2] Instituto de Investigación, Desarrollo e Innovación en Biotecnología Sanitaria de Elche (IDiBE), Universidad Miguel Hernández (UMH), 03202 Elche, Spain. CIBER, Fisiopatología de la Obesidad y la Nutrición, CIBERobn, Instituto de Salud Carlos III (CB12/03

The agro-food industry faces a continuous challenge in sustainably managing the by-products generated during production processes. The implementation of circular economy strategies transforms these residues into high-value resources, thereby contributing to both environmental and economic sustainability. Within this framework, the present project focuses on the valorization of pomegranate peel (*Punica granatum L.*), a by-product predominantly discarded despite its richness in polyphenolic bioactive compounds, such as tannins and flavonoids. These compounds are widely recognized for their potent antioxidant, anti-inflammatory, dermocosmetic, and nutraceutical properties.

Through advanced biotechnological extraction processes, pomegranate peel extracts were obtained, demonstrating a remarkable phenolic content of 64.68 ± 7.43 (g GAE/100 g of dry extract) and a high antioxidant capacity of 977.08 ± 15.73 (mmol Trolox/100 g of dry extract). These results establish pomegranate peel as a valuable and competitive resource for the formulation of cosmetic and nutraceutical products. Additionally, the residual plant material from the extraction process was optimized for the development of innovative biomaterials, including gym flooring and construction panels, highlighting its versatility and maximizing the project's sustainability impact.

In parallel, the bioactive compounds extracted from pomegranate peel were studied for their impact on the regulation of reactive oxygen species (ROS), which are critical in mitigating oxidative stress and maintaining cellular health. The results indicate that these compounds support gut microbiota balance and may contribute to the prevention of oxidative stress-related diseases.

This project fosters collaboration among agricultural producers, biotechnological companies, and logistical sectors, thereby strengthening the value chain within the agro-food industry. This approach exemplifies an innovative and scalable model of sustainability and circular economy, delivering significant environmental, social, and economic benefits.

sciforum-114687: Clarifying the Antioxidant and Antiproliferative Potential of *Nyctanthes arbor-tritis* Extracts by Combining Network Pharmacology and Molecular Docking

Kalpesh Rajendra Yeole * and Raju Ratan Wadekar

Department of Pharmacognosy, Shri Vile Parle Kelavani Mandal's Institute of Pharmacy, Dhule-424001, Maharashtra, India

Abstract

Nyctanthes arbor-tristis, commonly known as Parijat, is recognized for its significant antioxidant properties and various therapeutic applications. Recent studies have leveraged network pharmacology techniques to discover the main phytoconstituents in *Nyctanthes arbor-tristis* that may be able to alter the activity of important therapeutic targets implicated in oxidative stress and associated pathological processes. With an emphasis on its antiproliferative and antioxidant properties, this study combines computational methods to identify putative bioactive compounds and their relationships with important antioxidant enzymes and pathways, offering insights into the plant's potential to fight diseases brought on by oxidative stress. Using a variety of internet databases and software tools, the phytoconstituents of *Nyctanthes arbor-tristis* and their oxidative stress-related therapeutic targets were found. To determine if the found phytoconstituents were suitable as possible therapeutic agents, they underwent a drug-likeness study and were assessed for a number of pharmacokinetic characteristics. Targets exhibiting superior topological parameters and phytoconstituents with favorable pharmacokinetic profiles and drug-likeness properties were further examined using molecular docking studies and MMGBSA calculation to assess their binding affinities and interaction stability. In this investigation, 144 phytoconstituents were found in *Nyctanthes arbor-tristis*. Pharmacokinetic and drug-likeness tests were successfully completed by 103 of the 144 phytoconstituents that were discovered. For these chosen phytoconstituents, a total of 2192 therapeutic targets were discovered, along with 1823 oxidative stress-related disease-associated targets. Forty-four common targets were found when phytoconstituent targets and disease-associated targets intersected. The Cytoscape 3.9.1 program was used to assess topological metrics, including degree centrality and betweenness centrality, which led to the identification of five important proteins as top targets: SOD1, CAT, GPx1, Nrf2, and COX-2. Based on MMGBSA analysis and molecular docking experiments, beta-sitosterol is the most promising candidate since it has the best docking scores (-9.1 kcal/mol) and binding free energy across antioxidant (SOD1, CAT, GPx1, Nrf2) and antiproliferative (COX-2) targets.

sciforum-113142: Comparative analysis and antioxidant potential of hydroalcoholic extracts and infusions of cultivated ironwort

Paraskevi S. Sinou *, Vassiliki S. Birba, Vasilios A. Ioannidis and Fotini N. Lamari

Laboratory of Pharmacognosy and Natural Products Chemistry, Department of Pharmacy, University of Patras, Greece

Introduction

Sideritis raeseri Boiss. & Heldr., native to the Balkan Peninsula, is renowned for its composition, which is rich in diterpenoids and flavonoids. Its cultivation is rapidly expanding to meet the increasing demand for its aerial parts, particularly in beverage production and the pharmaceutical and cosmetic industries.

Methods

S. raeseri cultivated in the Prefecture of Achaia (Peloponnese, Greece) was harvested in June 2024 and the aerial parts were air-dried. Ultrasound-assisted extraction was performed, first with petroleum ether to remove volatile and lipid contents and then with 50% aqueous methanol. Additionally, infusions were prepared by steeping the plant material in water initially heated to 95°C for 10 minutes. The hydromethanolic extract and the infusion were analyzed using Liquid Chromatography coupled with Mass Spectrometry and UV/Vis spectroscopy. Antioxidant capacity was evaluated through Total Phenolic Content (TPC), Ferric Reducing Antioxidant Power (FRAP), and 2,2-diphenyl-1-picrylhydrazyl radical activity (DPPH•) assays.

Results

The primary constituents in the extract were verbascoside (19.22 mg/g dry extract weight), 4′-O-methyl-isoscutellarein 7-O-[6′′-O-acetyl-β-D-allopyranosyl-(1→2)]-β-D-glucopyranoside (15.93 mg/g), echinacin (14.26 mg/g), and chlorogenic acid (11.82 mg/g). The infusion contained fewer compounds but was rich in melittoside (31.39 mg/g dry infusion weight), with chlorogenic acid (4.29 mg/g) as the second most abundant compound. Despite differences in their quantitative profiles, the polar extract (TPC: 22.69 mg GAE/g; FRAP: 66.46 mg Fe(II)/g; DPPH scavenging: IC_{50} 2.17 mg/mL) and the infusion (19 mg GAE/g, 73.75 mg Fe(II)/g, and IC_{50} 2.58 mg/mL, respectively) exhibited comparable antioxidant activities across all assays.

Conclusions

These findings indicate that mountain tea infusions confer equipotent antioxidant protection to the hydromethanolic extract despite compositional variations, which can, however, affect other biological properties, warranting further investigation. Overall, this study highlights the potential of *S. raeseri* as a valuable natural source of antioxidants for industrial applications.

sciforum-114306: Comparison of commonly used methods for efficient extraction and quantification of polyphenols

Sadia Zulfiqar [1,*], Gizem Catalkaya [1], Meryem Benohoud [2], Phil Metcalfe [2] and Christine Boesch [1]

[1] School of Food Science and Nutrition, University of Leeds, UK
[2] Biopower Ltd, UK

Polyphenols, known for their antioxidant properties, are plant secondary metabolites whose efficient extraction depends on factors such as solvent type, extraction conditions, and sample matrix. The present study compared different commonly used extraction conditions to recover polyphenols from different dried fruit and vegetable combinations (mainly citrus, berries, and beetroot) to identify a broadly applicable approach suitable for a range of samples. Selected extraction conditions compared cold maceration with a sonication-assisted approach, different temperature conditions (RT and 60°C) and different ethanol (acidified) concentrations (30 and 80%) as extraction solvent. The total polyphenol content (TPC) was determined using the commonly used Folin–Ciocalteu assay as well as Fast Blue assay as an alternative option, which has recently been proposed as a more accurate reflection of the actual polyphenol content.

The results show consistently higher TPC across different samples following extractions with 30% ethanol than 80% as the extraction solvent, indicating better suitability for polyphenol extraction. Furthermore, samples extracted at RT showed higher TPC compared to samples extracted at 60°C. Whilst sonication-assisted extraction slightly improved TPC recovery in some samples, it was generally less favourable due to the prolonged sample processing time. When comparing the Folin–Ciocalteu versus Fast Blue assay, both methods for determining TPCwere highly reproducible, although the Fast Blue assay showed markedly higher values for all samples. The accuracy of the polyphenol assay methods is currently confirmed with HPLC.

In summary, based on the overall best performance of 30% ethanol extraction at RT, this approach could be recommended across a range of different samples. The different performance of the two polyphenol assays requires further attention, and more sensitive approaches such as HPLC should be employed to confirm their accuracy and reliability.

sciforum-110558: Cytotoxicity, antioxidant, anti-inflammatory, and sun protection potential of spray-dried *Punica granatum* peel extract

Aleksandra A. Jovanović [1], Andrea Pirković [1,*], Nada Ćujić Nikolić [2], Jelena Živković [2] and Katarina Šavikin [2]

[1] Institute for the Application of Nuclear Energy INEP, University of Belgrade, Banatska 31b, 11080 Belgrade, Serbia
[2] Institute for Medicinal Plant Research "Dr Josif Pančić", Tadeuša Košćuška 1, 11000 Belgrade, Serbia

Punica granatum (pomegranate) possesses strong antibacterial, antiviral, antioxidant, and anti-inflammatory activity due to the presence of various organic acids, alkaloids, phenolic acids, tannins, flavonoids, anthocyanins, sugars, fatty acids, and vitamins. Thus, in the present study, spray-dried pomegranate peel extract was examined in terms of its cytotoxicity and antioxidant, anti-inflammatory, and sun protection potential. The extract showed a concentration-dependent effect on keratinocyte viability, producing a decrease in the viability of the HaCaT cells with rising concentrations. While 25 µg/mL did not significantly reduce cell viability (12% reduction), concentrations of 50 and 100 µg/mL showed a more profound effect (23% and 27% reductions, respectively). In cells exposed to the extract alone, without H_2O_2, there was no significant change in reactive oxygen species (ROS) levels compared to a non-treated control. Keratinocytes pre-incubated with three different concentrations of peel extract (25, 50, and 100 µg/mL) for 24 h before H_2O_2 exposure showed significantly decreased levels of ROS compared to ones treated with H_2O_2 alone. All three examined concentrations showed a similar decrease in ROS production. In the cell line treated with spray-dried peel extract without lipopolysaccharide (LPS), there was no significant change in the expression of interleukin 1β or macrophage inhibitory factor (MIF), indicating the absence of any pro-inflammatory effects from the extract. In the LPS-treated cells, the extract significantly reduced interleukin 1β and MIF expression when pre-incubated for 24 h compared to LPS alone, confirming the anti-inflammatory potential of the extract against an LPS challenge. Additionally, the extract provided a sun protection factor (SPF) of 11.33±0.33 (at a concentration of 100 µg/mL), and significantly lower SPF values, 3.11±0.05 and 5.97±0.21, at lower concentrations (25 and 50 µg/mL, respectively), while an SPF of 6 is generally considered the minimum degree of UVB protection required for sunscreen products.

sciforum-111864: Eco-Friendly Ultrasound-Assisted Extraction of Quercetine from Cichorium Intybus Using Nadess and Commercial Solvents

Filip Balaz *, Ana Bojic, Katarina Arapovic, Ana Tomas Petrovic, Emilia Gligoric, Nevena Grujic-Letic and Branislava Teofilovic

University of Novi Sad, Faculty of Medicine, Hajduk Veljkova 3, 21000 Novi Sad, Serbia

Cichorium intybus, a medicinal plant, is valued for its bioactive compounds, such as flavonoids, phenolic acids, and other phytochemicals. In particular, quercetin is a flavonoid with potent antioxidant properties that combat oxidative stress and aid in preventing chronic diseases. Additionally, quercetin exhibits anti-inflammatory, antihistaminic, and immunomodulatory effects, making it a popular choice for promoting overall health. The objective of this study was to compare the extraction efficiency of quercetin using natural deep eutectic solvents (NADESs) based on glucose and glycerol with commercial solvents from the aerial parts of Cichorium intybus cultivated at the Institute “Dr. Josif Pančić.” Extraction was performed using eight solvents: five NADES formulations (glycerol–citric acid 1:1, glycerol–urea 1:1, glucose–lactic acid 1:1, glucose–urea 1:2, and glucose–glycerol 1:2) and three commercial solvents (water, ethanol, and methanol). Quercetin content was quantified using ultrasonic-assisted extraction. All NADESs outperformed the commercial solvents in extracting quercetin. The quercetin content extracted using NADESs ranged from 1.52 to 2.69 mg/g of crude extract, with the glucose–lactic acid NADES yielding the highest quercetin content at 2.69 mg/g of crude extract. In contrast, the quercetin levels obtained with commercial solvents ranged from 0.40 to 1.37 mg/g of crude extract. The NADESs demonstrated remarkable efficiency in extracting bioactive compounds such as quercetin due to their tunable physicochemical properties, including high polarity and hydrogen bonding capacity, which enhance solubility and selectivity. Additionally, NADESs are environmentally friendly, biodegradable, and non-toxic, making them a sustainable alternative to conventional organic solvents while improving extraction efficiency. Their unique ability to mimic natural cellular environments stabilizes sensitive bioactive compounds during extraction, preserving their antioxidant potential and functional properties.

Acknowledgments: This work is supported by Provincial Secretariat for Higher Education and Scientific Research, Province of Vojvodina (Grant No. 142-451-3474/2023).

sciforum-111672: Efficient Natural Deep Eutectic Solvent (NADES) Extraction of Gallic Acid as a Potent Antioxidant from Lamiaceae Plants

Branislava Teofilović *, Kristina Stanišić, Zorana Nikić, Nevena Grujić-Letić, Snežena Papović, Emilia Gligorić and Milan Vraneš

Faculty of Medicine, University of Novi Sad, Novi Sad, 21000, Serbia

Gallic acid is a potent antioxidant known for its ability to neutralize free radicals and protect cells from oxidative stress, thereby reducing the risk of chronic diseases such as cancer, cardiovascular disorders, and neurodegenerative conditions. The isolation of gallic acid using Natural Deep Eutectic Solvents (NADESs) offers significant benefits, as these solvents are eco-friendly, biodegradable, and enhance extraction efficiency. NADESs also help preserve the bioactivity of gallic acid, making this method a sustainable and effective alternative for its extraction in pharmaceutical and nutraceutical applications. This study aimed to evaluate the efficiency of gallic acid extraction from medicinal plants of the Lamiaceae family, cultivated at the Institute for Medicinal Plant Research. The extraction was conducted using two natural deep eutectic solvents—choline chloride/urea (1:1) and choline chloride/glucose (1:2)—as well as 70% ethanol. Ten herbal drug samples, including rosemary, lemon balm, sage, mint, lavender, oregano, savory, wild thyme, garden thyme, and basil, were analyzed. Gallic acid content in the extracts was quantified via high-performance liquid chromatography (HPLC). Both NADESs demonstrated an effective extraction of gallic acid, with choline chloride/glucose exhibiting superior performance. Gallic acid was successfully extracted using choline chloride/urea in concentrations ranging from 113.80 to 134.05 μg/g of crude drug, while choline chloride/glucose achieved a broader range of 113.02 to 209.68 μg/g of crude drug, with the highest yield observed in oregano. Choline chloride/glucose also outperformed ethanol extraction (120.73–144.93 μg/g of of crude drug). Both choline chloride-based NADESs showed significant potential as environmentally friendly solvents for extracting gallic acid. The results highlight the suitability of choline chloride/glucose for gallic acid extraction, with broader implications for the application of NADESs in the pharmaceutical and cosmetic industries.

Acknowledgments: This work is supported by Provincial Secretariat for Higher Education and Scientific Research, Province of Vojvodina (Grant No. 142-451-3474/2023).

sciforum-111900: Evaluation of Antioxidant Activity and Phenolic Content in Camellia Japonica Leaves: A Step Towards Applications in Functional Foods and Cosmetics

Ezgi Nur YUKSEK *, Rafael Nogueira-Marques, F. Chamorro, A. Gonzalez Pereira, P. Donn and M. A. Prieto

Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain

Camellia japonica is a plant species belonging to the Theaceae family; it is widespread in Asia. Although Camellia sinensis (tea) is one of the best-known species, C. japonica is scarcely known beyond its current ornamental value. However, C. japonica is recorded to have been used in traditional medicine, indicating its potential health benefits. The increasing population and demand for natural products has necessitated the investigation of potential bioactive constituents of such plants, which in many cases, has been correlated with their antioxidant properties. In this work, screening was performed on the potential of extracts obtained from C. japonica leaves as a source of natural antioxidant compounds. Antioxidant activity was determined in vitro by testing their radical scavenging activity against DPPH (2,2-diphenyl-1-picrylhydrazyl) and ABTS [2,2'-azinobis-(3-ethylbenzothiazoline-6-sulfonic acid)]. Total phenolic content (TPC) was measured as gallic acid equivalents (mg GAE/g) in accordance with previously established protocols. The results showed an IC50 value of 23.74 µg/mL for both DPPH and ABTS tests. TPC was measured as 36.67 mg GAE/g dry weight. These findings indicate that C. japonica leaves may have significant antioxidant activity, which can be related to their TPC. Further investigation of the phytochemical content and bioactivities of this matrix is required for its evaluation in health-related applications such as functional foods, nutraceuticals and cosmetics.

References

1. Christodouleas, D. C., Fotakis, C., Nikokavoura, A., Papadopoulos, K., & Calokerinos, A. C. (2015). Modified DPPH and ABTS Assays to Assess the Antioxidant Profile of Untreated Oils. Food Analytical Methods, 8(5), 1294–1302. https://doi.org/10.1007/s12161-014-0005-6
2. Genwali, G. R., Acharya, P. P., & Rajbhandari, M. (2013). Isolation of Gallic Acid and Estimation of Total Phenolic Content in Some Medicinal Plants and Their Antioxidant Activity. Nepal Journal of Science and Technology, 14(1), 95–102. https://doi.org/10.3126/njst.v14i1.8928

sciforum-112676: Evaluation of bioactive compounds and antioxidant activity of ten seeds' residues from oil processing

Roberta Pino [1,*], Vincenzo Sicari [2], Rosa Tundis [1] and Monica Rosa Loizzo [1]

[1] Department of Pharmacy, Health and Nutritional Sciences, University of Calabria, 87036 Arcavacata di Rende (CS),
[2] Department of Agraria, University "Mediterranea" of Reggio Calabria, Salita Melissari, Feo di Vito, Reggio Calabria (RC), 89124, Italy

Recent studies have highlighted that waste from the food industries is often rich in bioactive compounds that can be recovered and used again in a different market, therefore always contributing to the food economy [1]. This study aimed to investigate the bioactive compounds and radical scavenging effect of extracts from exhausted matrices of oil extraction from Cannabis sativa, Juglans regia, Prunus dulcis, Coriandrum sativum, Triticum aestivum, Nigella sativa, Avena sativa, Glycine max, Pimpinella anisum, and Pinus pinea. For this purpose, exhausted matrices were extracted using n-hexane and ethanol as solvents. The extracts were analysed by GC-MS analysis, while TPC was analyzed using the Folin–Ciocalteau method [2]. The radical scavenging activity was assessed using the DPPH and ABTS tests [2]. Additionally, samples were investigated for their ability for protection from lipid peroxidation [2]. Walnut's n-hexane extract exhibited the highest linoleic acid content (87.13%) . Anise extract by-products resulted in the richest TPC (35.8 mg GAE/ g extract). With regard to antioxidant activity, the almond by-product ethanolic extract exhibited the highest ABTS+· radical scavenging activity (IC50 of 2.6 ug/mL) whereas anise showed the highest DPPH radical scavenging potential (IC50 of 27.2 ug/mL) as well as the most promising protection from lipid peroxidation (IC50 of 14.1 ug/mL). Our results confirm that these by-products are still rich in active biological compounds. Therefore, these residues may be of interest to the food, nutraceutical and pharmaceutical industries in the continuous search for innovative products for healthy and nutritional applications for the extension of the shelf life of food products.

References

[1] da Silva, A.; Neuza, J Bioactive compounds of the lipid fractions of agro-industrial waste. *Food Res. Int.*, **2014**, *66*, 493-50. https://doi.org/10.1016/j.foodres.2014.10.025.
[2] Loizzo MR, Pugliese A, Bonesi M, Tenuta MC, Menichini F, Xiao J, Tundis R. Edible Flowers: A Rich Source of Phytochemicals with Antioxidant and Hypoglycemic Properties. *J Agric Food Chem*. **2016,** *64*. 2467-74. https://doi.org/10.1021/acs.jafc.5b03092.

sciforum-111700: Exploring Natural Deep Eutectic Solvents (NADESs) for Extraction of Antioxidant Compounds from Aromatic Herbs used in Mediterranean Diet

Inês Mansinhos *, Sandra Gonçalves and Anabela Romano

MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Faculdade de Ciências e Tecnologia, Universidade do Algarve, Campus de Gambelas, 8005-139 Faro, Portugal

Aromatic herbs are a fundamental component of the Mediterranean Diet (MD), enhancing the flavor of dishes and serving as a healthier substitute for salt. This not only enhances to the overall appeal of the diet, but also contributes to its health benefits, due to the richness of these herbs in bioactive molecules, such as phenolics, which possess antioxidant properties. The extraction of these compounds represents a crucial phase in their application in various industries. However, the use of conventional solvents poses risks to both the environment and human health. Green solvents, such as Natural Deep Eutectic Solvents (NADESs), have been identified as promising alternatives due to their non-toxic, eco-friendly, and less energy-demanding nature. The objective of this study was to assess the efficacy of two NADESs, namely glycerol--urea (Gly:U) (1:1) and choline chloride--lactic acid (CC:LA) (1:3), in comparison to the conventional solvent methanol for the extraction of phenolic compounds from six aromatic herbs which are commonly used in the MD: *Mentha spicata* L., *Coriandrum sativum* L., *Rosmarinus officinalis* L., *Thymus vulgaris* L., *Ocimum basilicum* L., and *Origanum vulgare* L. Extracts were obtained via ultrasound-assisted extraction. Phenolic and flavonoid contents were measured spectrophotometrically, and antioxidant activity was assessed via DPPH and ORAC assays. The results revealed higher phenolic concentrations in NADES extracts compared to methanol. *O. vulgare* extracted with Gly:U exhibited the highest phenolic content (99.45 ± 6.63 mg_{GAE}/g_{DW}), while *M. spicata* with Gly:U showed the highest flavonoid content (39.95 ± 0.55 mg_{QE}/g_{DW}). NADES extracts also demonstrated superior antioxidant activity in both assays. The findings suggest that extractions using NADESs are more effective than conventional solvents for extracting phenolics and promoting bioactivity. These green solvents are aligned with sustainable practices for use in various industries, thereby enhancing the valorization of Mediterranean herbs.

sciforum-111885: Exploring the antioxidant potential of green kiwifruit: Nutritional and phytochemical characterization of the peel and pomace

Franklin Chamorro [1,*], Rafael Nogueira-Marques [1], S. Seyyedi-Mansour [1], P. Barciela [1], Aurora Silva [2] and M.A. Prieto [1]

[1] Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain.
[2] REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Rua Dr. António Bernardino de Almeida 431, 4249-015 Porto, Portugal

---

The green kiwi (Actinidia deliciosa) is originally from China and widely known and consumed worldwide for its outstanding nutritional and functional properties that give it a high presence of antioxidant compounds. The high consumption of this fruit, both in its native form and in products derived from its industrialization, including juices, wines, jams and dehydrated fruits, among others, produces by-products such as the skin (GKS) and the bagasse (GKB). These were traditionally used for the generation of compost, discarded or burned. However, current research indicates that they constitute a natural source of antioxidant compounds with broad beneficial potential for health. In this sense, GKS and GKB were characterized from the nutritional and chemical point of view. The nutritional characterization (proteins, lipids and minerals) was carried out following the international standards of the AOAC International. For chemical characterization, heat-assisted extraction (HAE) was applied followed by a metabolomic study by HPLC-ESI-QqQ-MS/MS that allowed to identify and quantify the metabolites. The study reports that GKS and GKB constitute a source of nutrients, GKB highlighting 8.62 g/100 dw of protein and 8.60 g/100 dw of lipids of which 42% corresponds to polyunsaturated fatty acids. In contrast, GKS stands out for its high content of minerals K+, Ca+, P+, Mg+. The metabolomic study reports GKS 48.5% of phenolic acids, 29.8% of flavonoids and 21.7% of other polyphenols, while GKB contains 60.5% of phenolic acids, 15.4% of flavonoids and 24.1% of other polyphenols. These findings reinforce the theory that GKS and GKB constitute a natural source of compounds with antioxidant properties, which may have food, pharmaceutical and cosmetic applications, providing benefits for human health.

sciforum-111964: From Waste to Value: Phenolic Content and Antioxidant Potential in Labdanum Residues via Solid–Liquid and Subcritical Water Extraction

Filipe Jorge Fernandes [1,2,*], Cristina Delerue-Matos [1] and Clara Grosso [1]

[1] REQUIMTE/LAQV, Instituto Superior de Engenharia do Instituto Politécnico do Porto, Rua Dr. António Bernardino de Almeida, 431, 4249-015 Porto, Portugal
[2] Faculdade de Ciências da Universidade do Porto, Rua do Campo Alegre, s/n, 4169-007 Porto, Portugal

Cistus ladanifer L. is a Mediterranean shrub and is widely distributed in the Iberian Peninsula. It has high importance in the perfume industry and is used as a medicinal plant due to its essential oils. Its residues from distilleries, however, are underutilized. These residues are potential sources of phenolic compounds that can be extracted and used in several applications. In this work, extracts from distillery residues were produced using two methods, solid–liquid extraction (SLE) and subcritical water extraction (SWE). Two extracts were produced for each method, under different conditions. For the SLE extraction, the two treatment options were CLL40°C (1g:50 mL 50:50 water:methanol (v/v), 1 h extraction time, 40 °C) and CLL60°C (1g:100 mL 50:50 water:methanol (v/v), 1 h extraction time, 60 °C). For the SWE extraction, the extracts were produced by mixing 2 g of CLL with 200 mL of ultrapure water at 60 bar and 100 or 150 °C. The yield of the extraction was assessed, along with its total phenolic content (TPC) and antioxidant activity being assessed using different assays ($DPPH^{\bullet}$ and $ABTS^{\bullet+}$ scavenging activities and FRAP assay). CLL40°C displayed the highest TPC (175.24 ± 21.82 mg gallic acid equivalents/g dry extract) and the strongest antioxidant activity in the $DPPH^{\bullet}$ and $ABTS^{\bullet+}$ assays (267.81 ± 60.11 and 518.90 ± 50.16 mg Trolox equivalents/g dry extract). CLL60°C displayed the highest results in the FRAP assay (11.64 ± 2.96 mg ascorbic acid equivalents/g dry extract). The analysis of the SWE extracts is currently being performed and will be finished in time for the conference. These results will offer valuable information on the impact and potential of different extraction methods for the valorization of labdanum residues and phenolic extraction.

sciforum-114876: Functional Hydrogels Obtained Using 4D Printing: Incorporating Bioactive Extracts from Rhodiola rosea and Gotu Kola

Emilia Janusz [1,*], Julia Sztrumpf [1], Dominika Wanat [2], Magdalena Bańkosz [3], Magdalena Kędzierska [4] and Bozena Tyliszczak [1]

[1] Cracow University of Technology, Faculty of Materials Engineering and Physics, Department of Material Engineering, Cracow, Poland
[2] Cracow University of Technology, CUT Doctoral School, Faculty of Materials Engineering and Physics Department of Material Engineering, Cracow, Poland
[3] Cracow University of Technology, CUT Doctoral School, Faculty of Materials Engineering and Physics, Department of Material Engineering, Cracow, Poland
[4] Department of Chemotherapy, Medical University of Lodz, WWCOiT Copernicus Hospital

Introduction

The development of functional hydrogels through 4D printing represents a breakthrough in biomedical and pharmaceutical applications. By incorporating bioactive extracts from natural sources such as *Rhodiola rosea* (Różeńca górskiego) and *Centella asiatica* (Gotu Kola), these hydrogels offer enhanced therapeutic potential. The project investigates the chemical composition and properties of these plants and their extracts, aiming to utilize their bioactive compounds in hydrogel matrices.

Methods

The chemical composition of *Rhodiola rosea* and *Gotu Kola* extracts was analyzed using spectroscopic and chromatographic techniques to identify key bioactive components. Hydrogels were synthesized using sodium alginate, hyaluronic acid, and poly(vinyl alcohol), and were 4D-printed using a customized extrusion-based printer. The bioactive extracts were incorporated during the hydrogel preparation, ensuring their stability and functionality.

Results

The hydrogel matrices demonstrated high biocompatibility and stability, with controlled swelling and degradation profiles suitable for biomedical applications. Incorporation of *Rhodiola rosea* extract, rich in salidroside and rosavins, enhanced antioxidant and adaptogenic properties. Meanwhile, the inclusion of *Gotu Kola* extract, containing asiaticoside and madecassoside, significantly improved wound-healing and anti-inflammatory capabilities. The combined use of alginate, hyaluronic acid, and poly(vinyl alcohol) facilitated cross-linking, mechanical robustness, and sustained release of bioactive compounds.

Conclusions

This study highlights the potential of 4D-printed hydrogels as advanced biomaterials for drug delivery and tissue engineering applications. The integration of bioactive plant extracts from *Rhodiola rosea* and *Gotu Kola* offers a novel approach to enhancing the functional and therapeutic properties of hydrogels, paving the way for innovative solutions in regenerative medicine and pharmaceutical formulations.

Acknowledgments: Acknowledgments: This research was carried out within the SMART-MAT Functional Materials Scientific Club of the Faculty of Materials Engineering and Physics at Cracow University of Technology and as part of the project entitled " Functional hydrogels obtained using 4D printing" financed by the FutureLab organization operating at Cracow University of Technology

sciforum-111876: Grape pomace as significant source of antioxidants: Insights into variety effect and maximizing extraction yields

Javier Echave [1,2,*], Franklin Chamorro [1], Pauline Donn [1], Lillian Barros [2] and Miguel Angel Prieto [1]

[1] Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain
[2] CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300- 253 Bragança, Portugal

Phenolic compounds (PCs) derived from plant sources have been increasingly studied in recent decades for their potent antioxidant capacities, which relate to their application in health, food, cosmetics, and other industries. Particularly, grape pomace is a well-recognized rich and sustainable source of PCs, especially flavanols, of which their content of flavan-3-ols (or tannins) are particularly high. To maximize the yields of extraction of these PCs from grape pomace, various optimizations approaches have been made, especially regarding conventional methods such as heat-assisted extraction (HAE), Soxhlet, andenzyme-assisted extraction (EAE), but also on more modern and sustainable technologies. The latter include ultrasound (UAE) and microwave-assisted extraction (MAE), pressurized liquid extraction (PLE), and pulse-electric fields (PEFs), among others. For instance, Merlot pomace has been reported to achieve yields of 65 mg gallic acid equivalents (GAE)/g dry extract (de) by HAE, 49 mg GAE/de by UAE, or 71 mg GAE/de by MAE. However, the effectiveness of an extraction method is not only measured in yield, but also in time, the use of solvents, and extraction yield, of which MAE, UAE, and other sustainable techniques stand out. Various parameters affect the extraction yield and PC composition, depending on the extraction method, i.e., temperature, time, solvent proportion, solvent choice, or method-inherent parameters, such as power or pressure. Moreover, grape variety has significance in PC composition and concentration. Considering these facts, an in-depth assessment of the optimum methods focusing on the yield of PCs from grape pomace should also consider the diversity of each grape's variety and origin. This work will present updated information onthe maximum yields achieved for grape pomace PCs (focusing on anthocyanins, resveratrol, and flavanols), and provide a comprehensive vision regarding the weight and effect of each method and their intrinsic parameters in PC extraction yields.

sciforum-111720: Green extraction of antioxidant compound (quercetin) from *Salix amplexicaulis* species using natural deep eutectic solvents

Milica Vidić *, Nevena Grujić-Letić, Branislava Teofilović and Emilia Gligorić

University of Novi Sad, Faculty of Medicine, Serbia

Certain *Salix* species have been reported to exhibit significant antioxidant activity across various in vitro and in vivo systems. To preserve the environment, reduce humans' negative impact in the field of chemistry, enhance extraction efficiency, and improve the stability of extracted components, this study combined natural deep eutectic solvents (NADESs) with microwave-assisted extraction (MAE) to isolate the highly effective antioxidant quercetin. This study investigated the efficiency of the novel green extraction method, MAE-NADES, to recover the potent antioxidant quercetin from the underexplored leaves and bark of *Salix amplexicaulis*. Furthermore, the potential of NADES as a sustainable alternative to conventional solvents was assessed by comparing MAE-NADES with MAE-water and traditional ethanol maceration. NADES based on lactic acid-glycerol, lactic acid-glucose, glycerol-glucose, and glycerol-urea were synthesized by heating and stirring. Extracts of *Salix amplexicaulis* were obtained through forty-eight-hour ethanol maceration and MAE. In MAE, water and NADES were used as solvents, and the extraction was carried out in three cycles, each lasting eight seconds. The quercetin content of extracts was characterized by high-performance liquid chromatography (HPLC). The quercetin content ranged from 0.31 to 1.56 mg/g in crude bark and from 0.30 to 2.04 mg/g in crude leaf. NADESs were superior to water and ethanol extraction, recovering from the bark 4 to 5 times more quercetin than water and 2.5 to 3 more quercetin than ethanol. As for NADES leaf extracts, quercetin amounts were 4.5 to 7 times higher than in aqueous extract and 3.5 to 5 times higher compared to ethanolic extract. Considering the obtained results, MAE-NADES demonstrated significant potential as a sustainable and efficient alternative for quercetin extraction from *Salix amplexicaulis*, including faster and more cost-effective preparation, high extraction efficiency, and environmentally friendly characteristics.

Acknowledgments: This work was supported by the Provincial Secretariat for Higher Education and Scientific Research, Province of Vojvodina (Grant No. 142-451-3474/2023).

sciforum-114140: How different cooking methods can affect the glucosinolates and their degradation product in Brassica vegetebals. Literature review

Amina Azi Madani [1,*], Franklin Chamorro [2], Naima Guendouz Boucheffa [1], Ezgi Nur Yuksek [2], Sana Nesrine Kerour [1], Hameza Elrobrini [1], Nadia Madi Bouaoudia [1], A. G Pereira [2,3], M. Carpena [2] and M.A. Prieto [2]

[1] Research Laboratory of Biochemistry, Biophysics, Biomathematics and Scientometrics "L3BS" University of Bejaia "Algeria" Route Targua-Ouzemour, 06000/Bejaia/Algeria
[2] Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain.
[3] Investigaciones Agroalimentarias Research Group, Galicia Sur Health Research Institute (IIS Galicia Sur). SERGAS-UVIGO

Brassica vegetables are known for their glucosinolate content. These secondary metabolites are responsible for the bitter taste present in these vegetables. Glucosinolates and their degradation products have been well documented for their powerful anti-cancer, anti-inflammatory and antioxidant properties and play a key role in reducing oxidative stress. This property is due not only to glucosinolates in their intact form, but also to their degradation products, such as isothiocyanates and indoles, which are generated during enzymatic and thermal processes. Cooking can significantly modify the concentration and composition of these compounds, influencing their bioavailability and bioactivity. Investigating the effects of various cooking techniques on glucosinolate content and bioavailability is vital to maximizing the potential health benefits of these extraordinary vegetables. Understanding the intricate relationship between cooking methods and glucosinolate preservation may help to optimize the health-promoting potential of cruciferous vegetables in dietary practices. Cooking induces significant changes in the chemical composition of foods, depending on the cooking method, temperature, and cooking time. In general, the literature agrees that cooking methods affect the nutritional quality of Brassica vegetables. Steaming and other gentle cooking techniques are recommended to preserve glucosinolates and their degradation products, while boiling should be minimized due to its detrimental effects on these compounds. This study aims to analyze and synthesize the existing information in the literature dealing with this topic and to select the main cooking methods used for Brassica vegetables. Then, to evaluate the impact of each cooking method on the stability, retention, and degradation of glucosinolates and their degradation products.

sciforum-111711: Impact of UV-B Radiation on Antioxidant and Dye Removal Capacity of *Thymus lotocephalus* green extracts

Inês Mansinhos [1,*], João Brás [1], Sandra Gonçalves [1], Raquel Rodríguez-Solana [1,2] and Anabela Romano [1]

[1] MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Faculdade de Ciências e Tecnologia, Universidade do Algarve, Campus de Gambelas, 8005-139 Faro, Portugal

[2] Department of Agroindustry and Food Quality, Andalusian Institute of Agricultural and Fisheries Research and Training (IFAPA), Rancho de la Merced Center, Carretera Cañada de la Loba (CA-3102) Km 3.1., SN, 11471 Jerez de la Frontera, Cádiz, Spain.

To counteract the oxidative stress induced by abiotic stress factors such as UV-B radiation, plants typically activate both enzymatic and non-enzymatic molecules (e.g., phenolic compounds) with antioxidant functions. The aim of this work was to evaluate the impact of UV-B radiation on the phenolics production and antioxidant activity of green from *Thymus lotocephalus*, an endangered aromatic species endemic to the Algarve (Portugal). Additionally, the methylene blue (MB) removal capacity of hydrogels loaded with the antioxidant extracts produced was tested as a potential eco-friendly strategy for dye removal from contaminated water. In vitro cultures (ICs) and micropropagated plants (MPs) of *T. lotocephalus* were subjected to two distinct treatments of UV-B radiation (4 hours/1 day or 4 hours/4 days). Following exposure to UV-B radiation, extracts were obtained through ultrasound-assisted extraction using a Natural Deep Eutectic Solvent, choline chloride--lactic acid (1:2). HPLC-HRMS analysis showed that UV-B significantly increased the production of the major compound (rosmarinic acid), especially in IC (+41% over the control). Furthermore, the antioxidant activity of the extracts, assessed through ABTS, DPPH, FRAP, and ORAC assays, was also enhanced by UV-B. Hydrogels were prepared by incorporating extracts from IC or MP. The ability of these hydrogels to adsorb MB was assessed, and the adsorption conditions were optimized using response surface methodology. Hydrogels made with UV-B-exposed MP extracts exhibited superior MB adsorption compared to controls. Antioxidant activity and MB adsorption were significantly positively correlated. This suggests that the antioxidant properties of phenolics enhance adsorption complex stability, maintaining adsorption site integrity and ensuring hydrogel's long-term stability. The findings highlight the potential of a novel eco-friendly hydrogel rich in antioxidants as effective adsorbents for MB removal. This innovation offers a sustainable approach to addressing wastewater pollution caused by synthetic dyes, contributing to environmental remediation efforts.

sciforum-111717: Improving olive leaf extract bioavailability through encapsulation: in vitro digestion and intestinal permeability

Marta Fernández-Oliver [1,*], María Losada-Echeberría [1], Carlos Abellán-Dieguez [2,3], Francisco Javier Leyva-Jiménez [2,3], María Herranz-López [1], M. Elena Alañón [2,3], Vicente Micol [1] and Enrique Barrajón-Catalán [1]

[1] Instituto de Investigación, Desarrollo e Innovación en Biotecnología Sanitaria de Elche (IDiBE), Universidad Miguel Hernández (UMH), 03202 Elche, Spain
[2] Instituto Regional de Investigación Científica Aplicada (IRICA), Universidad de Castilla-La Mancha (UCLM), 13071 Ciudad Real, Spain
[3] Escuela Técnica Superior de Ingenieros Agrónomos, Universidad de Castilla-La Mancha (UCLM), 13071 Ciudad Real, Spain

The bioavailability of natural antioxidants remains a critical challenge in the development of effective nutraceuticals. Instability during digestion and limited intestinal absorption often compromise the efficacy of these compounds when administered orally. Encapsulation technologies offer a promising approach to improve the stability and absorption of natural compounds, particularly those derived from agri-food by-products, contributing to their valorisation.

The aim of this work is to obtain encapsulated olive leaf extract formulations and to evaluate the available fraction and intestinal permeability of these formulations. An in vitro gastrointestinal digestion test was carried out according to the harmonised INFOGEST protocol, in which the fluids and enzymatic processes of the oral, gastric and intestinal phases are successively simulated. This was followed by an intestinal permeability test using the Caco-2 cell monolayer model. For this, samples of fully digested formulations were placed in the donor chamber, and samples were collected from the acceptor chamber at different time points. Transport across the membrane in both directions from the apical or basolateral domain of the epithelium was also studied. The major component of the extract in all samples was quantified by high-performance liquid chromatography coupled to mass spectrometry.

Apparent permeability coefficients were calculated in the apical–basolateral direction and vice versa, allowing for the calculation of the efflux ratio and for the assessment of the type of transport and the permeation rate. Three of the four encapsulated formulations showed moderate permeability values, together with the non-encapsulated extract. Formulation B showed significant differences; however, formulation C decreased the efflux rate, which, together with a higher available fraction, improved the permeation rate. This evaluation provides information on the usefulness of encapsulation in enhancing the absorption of bioactive compounds, useful for the development of more effective nutraceutical products.

sciforum-111910: Macroalgae as a Source of Antioxidant Compounds: Extraction and Characterization

Maria Carpena [1,*], Aurora Silva [1,2], Paula Barciela [1], Rafael Nogueira-Marques [1], Ana Perez-Vazquez [1], Pauline Donn [3] and Miguel A. Prieto [1]

[1] Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain.
[2] REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Rua Dr António Bernardino de Almeida 431, 4200-072 Porto, Portugal
[3] Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Faculty of Science, E32004 Ourense, Spain

Rising awareness about the advantages of natural antioxidants has driven efforts to explore alternative natural sources for these compounds. Macroalgae are a promising source of these bioactive compounds. Brown macroalgae are renowned for their ecological significance, metabolite diversity, and potent bioactive attributes. These metabolites, spanning polysaccharides, phenolic compounds, and terpenoids, play a dual role by influencing the ecological dynamics of the algae and exhibiting noteworthy bioactive characteristics, highlighting their antioxidant potential as the common driver of their effects. This study aimed to characterize four brown macroalgae by comparing two orders, Fucales (*Fucus vesiculosus* and *Pelvetia canaliculata*) and Laminariales (*Laminaria ochroleuca* and *Saccharina latissima*), searching for bioactive compounds, namely, pigments and phlorotannins, with antioxidant properties, and to later optimize their extraction by Heat-Assisted Extraction (HAE) and Pressurized Liquid Extraction (PLE). The experiments were designed following a response surface methodology *(*RSM*).* Extraction was performed according to the following independent variables: for HAE, time (t, 5-60 min), temperature (T, 30-90°C) and solvent concentration (S, 0-100% ethanol) and for PLE, time (t, 1-50 min), temperature (T, 50-200°C) and ethanol percentage of the solvent (*S*, 0-100%). Phenolic compounds and pigments were identified by HPLC-ESI-QqQ-MS/MS following the previous methodology. In both cases, PLE improved the extraction of active compounds. The extraction yield of *F. vesiculosus* – PLE ranged from 9.1 to 63.4%, obtaining the best ratio among the tested species. Phlorotannins and carotenoids were the most frequent compounds to exhibit antioxidant properties. The presence of quinic acid and scopoletin was also characterized. This work will shed light on the optimization and potential of these algae-derived compounds, paving the way for further research in natural antioxidants for industrial application.

sciforum-111886: Optimization of antioxidant extraction through artificial neural networks

Paula Barciela Álvarez [1,*], A. Perez-Vazquez [1], M. Carpena [1], A. G. Pereira [1,2], A.O.S. Jorge [1,3], Ezgi Nur Yuksek [1] and M.A. Prieto [1]

[1] Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain.
[2] Investigaciones Agroalimentarias Research Group, Galicia Sur Health Research Institute (IIS Galicia Sur). SERGAS-UVIGO.
[3] REQUIMTE/LAQV, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, R. Jorge Viterbo Ferreira 228, 4050-313 Porto, Portugal.

The increasing demand in modern society for natural sources of bioactive compounds with potential applications in preventive medicine has driven the development of innovative approaches to optimize extraction processes. While Response Surface Methodology (RSM) has been extensively utilized for prediction and optimization in extraction studies, Artificial Neural Networks (ANNs) provide a powerful alternative by enabling the development of nonlinear computational models. These models are capable of self-learning and training to address practical challenges, without relying on predefined mathematical equations, by mimicking the structure and functionality of biological neural networks. The application of ANNs offers numerous advantages, including the ability to interpret complex datasets, scale results through optimization and parallelization, and model complex, nonlinear relationships. Furthermore, ANNs allow for the handling of large datasets and generalization across systems, without the limitations of predefined models or specific experimental designs. This systematic review compiles studies on the application of ANNs in the optimization of extraction processes of antioxidants present in natural matrices (e.g., edible plants, vegetables, and fruits), providing an objective evaluation of their potential for the sustainable development of industrial products enriched with these compounds. Special attention is given to how ANNs outperform traditional techniques, such as RSM, in predicting yields, enhancing extraction efficiency, and minimizing resource consumption. By exploring key studies and methodologies, this review aims to highlight the role of ANNs in advancing green and sustainable technologies, offering novel insights into their applicability in designing industrial processes that incorporate natural antioxidants into food, cosmetics, and pharmaceutical products.

sciforum-111715: Optimizing the green synthesis of silver nanoparticles with pomegranate extract for antibacterial purposes: an innovative approach

Rocío Díaz-Puertas [1,*], Francisco Javier Álvarez-Martínez [1], Pedro Valentín Badía Hernández [1], Enrique Rodríguez-Cañas [1], Fernando Borrás Rocher [1], Alberto Falcó [2] and Ricardo Mallavia [1]

[1] Institute of Research, Development and Innovation in Healthcare Biotechnology of Elche (IDiBE), Miguel Hernández University (UMH), Elche, 03202, Spain.
[2] Fish Pathology group, Institute of Aquaculture Torre de la Sal (IATS-CSIC), Castellón, 12595, Spain

Introduction

The growing demand for eco-friendly and sustainable approaches in nanotechnology has highlighted plant extracts as versatile and renewable resources for the synthesis of metal nanoparticles. Pomegranate (*Punica granatum*) peel, an agro-industrial byproduct, is particularly well suited for this purpose due to its high content of bioactive compounds, such as punicalagin, ellagic acid, and flavonoids, which exhibit potent antioxidant activity. These phytochemicals not only scavenge free radicals but also play a crucial role as reducing and stabilizing agents in the green synthesis of metal nanoparticles. This study investigates the potential of pomegranate peel extract from the "Mollar de Elche" variety for the synthesis of sustainable silver nanoparticles (AgNPs) and emphasizes the influence of its bioactive compounds on nanoparticle properties.

Methods

Pomegranate extract was obtained from pomegranate peels. A Box–Behnken Design (BBD) programmed in Python was employed to optimize key synthesis parameters such as silver nitrate concentration, extract concentration, and temperature, while minimizing experimental trials. The optimized AgNPs were characterized by UV-Vis spectroscopy, FTIR, XRD, and FESEM, and their antibacterial activity was evaluated.

Results

The optimization process revealed significant interactions between the responses, including hydrodynamic diameter, polydispersity index, and zeta potential. Characterization of the AgNPs confirmed the successful reduction and capping of silver ions by pomegranate-derived compounds. Antibacterial assays revealed strong activity against *Escherichia coli* and *Staphylococcus aureus*. Furthermore, the AgNPs were incorporated into nanofibrous scaffolds as a proof of concept for future applications, and their antibacterial activity was partially retained post-incorporation.

Conclusions

This work highlights the versatility of pomegranate peel extract as a sustainable and multifunctional medium for nanoparticle synthesis, driven by its rich composition of antioxidant compounds. Furthermore, it demonstrates how integrating computational tools like BBD with green chemistry principles can efficiently optimize complex processes, paving the way for industrial and biomedical applications.

sciforum-111908: Patent Landscape Analysis of Antioxidants from *Lamiaceae* Plants: Innovations and Applications

Reda El Boukhari [1,*], Maima Matin [2], Atanas G. Atanasov [2,3] and Ahmed Fatimi [1]

[1] Chemical Science and Engineering Research Team (ERSIC), Department of Chemistry, Polydisciplinary Faculty of Beni Mellal (FPBM), Sultan Moulay Slimane University (USMS), P.O. Box 592 Mghila, Beni Mellal 23000, Morocco
[2] Institute of Genetics and Animal Biotechnology of the Polish Academy of Sciences, Jastrzebiec, 05-552 Magdalenka, Poland
[3] Ludwig Boltzmann Institute Digital Health and Patient Safety, Medical University of Vienna, Spitalgasse 23, 1090 Vienna, Austria

This patent landscape study provides a detailed overview of innovation in antioxidants derived from *Lamiaceae* plants, offering valuable insights into current trends and future opportunities for research and industrial development. As medicinal preparations, antioxidants from plants such as rosemary, thyme, and lavender are increasingly used in treatments targeting oxidative stress and related health conditions. The primary focus lies on the antioxidant properties of *Lamiaceae* plants, which have gained significant attention for their ability to scavenge free radicals, providing vital protection against oxidative damage.

To identify patents related to plant-based antioxidants derived from the *Lamiaceae* family, we followed an approach based on the intersection of different Cooperative Patent (CPC) codes, which enables the identification of relevant patents by combining therapeutic applications, medicinal preparations, and botanical classifications. The results of this analysis were then presented in terms of publication trends, jurisdictional distribution, key players, classification overview, and technological focus within market dynamics.

The data indicate a steady increase in the number of patents published from 2001 to 2021. The analysis shows a diverse distribution of key players across regions. China leads in terms of both the number of applicants and innovation diversity, followed by the United States and Europe. Asia's robust representation underscores the global importance of *Lamiaceae*-derived antioxidants in various industrial sectors. The presence of European players indicates a steady focus on applications with high commercial value, such as cosmetics and functional foods, while North American companies drive advancements in pharmaceuticals and nutraceuticals. The CPC subgroup analysis demonstrates that patents for antioxidants from *Lamiaceae* plants are mainly concentrated in medicinal, dermatological, and cosmetic applications. The versatility of these plants supports innovation in pharmaceuticals, skincare, and wellness products, with a growing trend towards natural and sustainable solutions in various industries.

sciforum-113707: Phytochemical Screening and In Vitro Antioxidant Analysis of Medicinal Plants for Phyto-Pharmaceutical Resources

Raju Ratan Wadekar * and Kalpesh Rajendra Yeole

Department of Pharmacognosy, Shri Vile Parle Kelavani Mandal's Institute of Pharmacy, Dhule-424001, Maharashtra, India

Medicinal plants have been essential in traditional medicine and continue to play a significant role in modern pharmaceutical and nutraceutical industries, particularly for their antioxidant properties. In this study, we examined the phytochemical composition and antioxidant activity of extracts from the leaves of *Trichosanthes lobata* Roxb and *Uvaria narum* Wall ex Wight, and the bark of *Zanthoxylum armatum* DC. Both alcoholic and aqueous extracts were analyzed for their polyphenol and flavonoid content using High-Performance Thin Layer Chromatography (HPTLC) and spectrophotometric methods. The alcoholic extract of *Z. armatum* bark contained the highest polyphenol content (216 ± 5.1 mg/g gallic acid equivalent), followed closely by the aqueous extract of *T. lobata* leaves (213 ± 1.9 mg/g). Regarding flavonoid content, the aqueous leaf extract of *T. lobata* was the most abundant (64 ± 5.5 mg/g quercetin), while the alcoholic leaf extract of *U. narum* contained 42 ± 3.5 mg/g quercetin. Antioxidant activity was evaluated through DPPH and nitric oxide (NO) scavenging assays. The aqueous extract of *T. lobata* exhibited the highest DPPH scavenging activity (89.3 ± 3.4%) at 200 µg/mL, comparable to ascorbic acid. The alcoholic leaf extract of *U. narum* displayed the highest NO scavenging activity (85.7 ± 3.2%). Additionally, the total antioxidant capacity (TAC) of *T. lobata* was 3.5 ± 0.2 mmol of ascorbic acid equivalents per gram, and its ferric-reducing antioxidant power (FRAP) was 456 ± 3.7 µmol Fe^{2+}/g. These findings demonstrate the strong antioxidant potential of *T. lobata, U. narum,* and *Z. armatum*, highlighting the value of *T. lobata* leaves due to the presence of quercetin and gallic acid flavonoid as a promising source for the development of functional foods, nutraceuticals, and phytopharmaceuticals.

sciforum-111922: Plant-Derived Mucilage: A Natural Antioxidant with Multifunctional Applications in Food, Cosmetics, and Health

Rajeshwari Satish Patil * and Mohan Ganpatrao Kalaskar

Department of Pharmacognosy, R.C. Patel Institute of Pharmaceutical Education and Research, Shirpur, Maharashtra, India

Mucilage, naturally occurring polysaccharides in various plant parts, possesses unique structural and multifunctional properties. These biopolymers consist primarily of complex polysaccharides associated with bioactive compounds, such as flavonoids, phenolics, and oxidized sugars. They have distinctive, potent antioxidant, anti-inflammatory, and protective effects against cellular aging and disease progression. As natural excipients, they offer therapeutic benefits alongside conventional drug delivery functions. The health advantages of mucilage include weight management, blood sugar control, improved gut and cardiovascular health, anti-inflammatory activities, and immune support. Recent studies highlighted their antioxidant and wound-healing properties, alongside their emerging use in cosmetic formulations for skin hydration and oxidative damage protection. A systematic review of databases like PubMed, Scopus, and Web of Science evaluated 22 research papers on mucilage with antioxidant potential. Key findings include the following antioxidant-containing mucilage sources: *Cydonia oblonga* (seeds) has an IC_{50} of 30.64%; *Abelmoschus esculentus* (pods and seeds) shows 23.04% and 40.40% IC_{50} values; *Zizyphus mauritiana* (fruits) shows 76.13% IC_{50}*; Coccinia indica* (leaves) shows a 71.85% IC_{50} value; *Hibiscus rosa-sinensis* has a value of 44.55±0.05% (80µg/mL); *Malva parviflora* has an IC_{50} value of 58.54±1.46 (80 µg/mL); *Corchorus olitorius* has an IC_{50} value of 30.19% (leaves); and *Dioscorea opposita* (Tubers) has an IC50 value of 68.57%. Among these mucilage sources, *Hibiscus rosa-sinensis* shows more inhibition on DPPH assay compared to reducing power assay, hydroxyl superoxide, hydrogen peroxide, and nitric oxide scavenging assay. Surprisingly, crude *Zizyphus mauritiana* fruit mucilage shows higher activity in its superoxide radical-scavenging ability (85.12%) as compared to hydroxyl radical-scavenging ability. Various analytical techniques have been used for the evaluation of the antioxidant properties of mucilage, inclusing 2,2-diphenyl-1-picrylhydrazyl, 2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) assay, ferric reducing antioxidant power assay, hydroxyl radical assay, and superoxide radical assay. This review emphasizes the potential therapeutic roles of plant mucilage with phenolic compounds. The findings aim to foster innovation in the health benefits of mucilage and its applications in food and cosmetic products, leveraging the multifunctional potential of these biopolymers to enhance efficacy and safety.

sciforum-111530: Polyphenols from Onion Skin Waste: A Natural Antioxidant Source with Beneficial Health Applications

Esther Trigueros Andrés [1,2,*], Óscar Benito-Román [2], Andreia P. Oliveira [1,3,4], Romeu A. Videira [1], Eugénia Pinto [5,6], Paula B. Andrade [1], Maria T. Sanz [2] and Sagrario Beltrán [2]

1 REQUIMTE/LAQV, Laboratório de Farmacognosia, Departamento de Química, Faculdade de Farmácia, Universidade do Porto, R. Jorge Viterbo Ferreira, nº 228, 4050-313 Porto, Portugal.
2 Department of Biotechnology and Food Science, Chemical Engineering Division, University of Burgos, Plza. Misael Bañuelos s/n 09001 Burgos, Spain.
3 Associate Laboratory i4HB – Institute for Health and Bioeconomy, University Institute of Health Sciences – IUCS-CESPU, 4585-116 Gandra, Portugal
4 UCIBIO – Research Unit on Applied Molecular Biosciences, Translational Toxicology Research Laboratory, University Institute of Health Sciences (1H-TOXRUN, IUCS-CESPU), 4585-116 Gandra, Portugal
5 Laboratory of Microbiology, Biological Sciences Department, Faculty of Pharmacy, University of Porto, 4050-313 Porto, Portugal
6 Interdisciplinary Centre of Marine and Environmental Research (CIIMAR), University of Porto, 4450-208 Matosinhos, Portugal

Onion (*Allium cepa* L.) is one of the most important vegetable crops worldwide. However, its processing generates significant amounts of waste, primarily consisting of peels and skins. Despite being rich in bioactive compounds, these residues are typically discarded in landfills, raising environmental challenges. This study aims to valorize onion skin (OS) wastes by producing flavonoid-rich extracts with significant bioactive potential. The specific objectives include analyzing the chemical composition of the extracts, specifically their phenolic content, assessing their antioxidant, antidiabetic, and anti-inflammatory activities, and their antimicrobial effects, along with their cytotoxicity on human cells to ensure their safety.

The primary components in the OS extracts were phenolics and flavonoids, with quercetin and quercetin-4'-O-glucoside being the major identified phenolics, while sugars and proteins were present at less than 11%. The extracts exhibited strong •NO radical scavenging activity and even greater efficiency against $O_2^{\bullet-}$ anion radical (IC_{50}=26-27.7µg/mL). In terms of antidiabetic activity, the extracts completely inhibited aldose-reductase and α-glucosidase while preserving α-amylase activity, thus avoiding side effects associated with its inhibition. Anti-inflammatory effects were demonstrated by inhibiting 5-lipoxygenase (IC_{50}=30.2-47µg/mL) and reducing NO production in IFN-activated BV-2 cells to basal levels, indicating anti-neuroinflammatory potential, without showing cytotoxic effects on human cell lines. Additionally, the antimicrobial properties of the extracts were highlighted by their effective anti-dermatophytic activity. In summary, OS has been shown to be a natural source of flavonoids, mainly quercetin and its glucosides, exhibiting diverse biological activities and a favorable safety profile. These findings support their potential application in food supplements, functional foods, and nutraceuticals.

sciforum-107435: Preparation, physicochemical characterization, and application of edible films based on pectins and flavonoids from citrus by-products

Huan Guo

College of Biomass Science and Engineering and Healthy Food Evaluation Research Center, Sichuan University, Chengdu, 610065, China

Amid the global drive to identify green, and sustainable materials and natural antioxidants to meet the demands for biodegradable packaging materials in terms of yield, qualification, and application, citrus peels emerge as abundant, inexpensive, and often overlooked green sources suitable for innovative food packaging. In this study, citrus flavonoids (CF) and citrus pectin (CP) were obtained through sequential extraction technology from citrus by-products, followed by preliminary purification and characterization. The findings revealed that CP is an acidic heteropolysaccharide rich in arabinose and galacturonic acid, with hesperidin being the predominant flavonoid constituent of CF. Subsequently, we encapsulated CF into a matrix comprising soy protein isolate (SPI) and CP, creating innovative active films. These films were thoroughly assessed for their antioxidant, antimicrobial, physicochemical, morphological, optical, barrier, and mechanical properties. The results indicated a significant enhancement in the mechanical strength, heat resistance, and barrier properties of the composite films upon the addition of CP and CF. Moreover, the CF-loaded composite films exhibited remarkable antioxidant properties and demonstrated inhibitory effects against both *Escherichia coli* and *Staphylococcus aureus*. Employing these antimicrobial edible films for post-harvest preservation of red-grapes and pork revealed their effectiveness in extending the shelf life of both. Particularly, SPI/CP-CF films showed exceptional potential in prolonging the shelf life of red-grapes and pork, attributed to their reduced water vapor permeability and oxygen permeability values, along with their active antioxidant and antibacterial attributes. In conclusion, these composite films exhibit significant promise as multifunctional active packaging materials for fruit and pork preservation. Additionally, considering that citrus peels are by-products generated during food processing, transforming these readily available waste resources into value-added materials represents an innovative and sustainable approach, contributing to eco-friendliness.

sciforum-111902: Protective Antioxidants in Seafood: Supporting Health and Combating Disease

Ana Olivia Serra Jorge [1,2,*], Franklin Chamorro [1], Javier Echave [1,3], Maria Carpena [1], Ezgi Nur Yuksek [1], Maria Beatriz Prior Pinto Oliveira [4] and Miguel Angel Prieto [1]

[1] Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, España.
[2] REQUIMTE/LAQV, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, R. Jorge Viterbo Ferreira 228, 4050-313 Porto, Portugal
[3] CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300- 253 Bragança, Portugal
[4] LAQV@REQUIMTE, Department of Chemical Sciences, Faculdade de Farmácia, Universidade do Porto, R. Jorge Viterbo Ferreira 228, 4050-313, Porto, Portugal

Antioxidants from seafood play a crucial role in promoting human health by providing a natural source of compounds that mitigate oxidative stress. Oxidative stress, usually as a result of antioxidant imbalance, is strongly linked with DNA damage, inflammation, metabolic diseases, and other hazardous events. This intricate process can be ameliorated by endogenous antioxidant enzymes and molecules, but also by intake of antioxidants naturally present in food. Seafood is rich in bioactive antioxidants like astaxanthin, tocopherols, selenium, coenzyme Q10, glutathione, and omega-3 fatty acids, all of which have demonstrated significant potential in reducing cellular oxidative damage.

Some antioxidants in fish, such as astaxanthin, tocopherols, and selenium, collaborate in mitigating oxidative stress by neutralizing free radicals. This action helps to reduce cellular damage, thereby lowering the risk of chronic diseases such as cancer, cardiovascular diseases, and neurodegenerative disorders. Astaxanthin, a carotenoid found in certain fish species like salmon and trout, is known for its superior antioxidant capacity, surpassing vitamin E and other carotenoids. Tocopherols (vitamin E compounds) also contribute to the prevention of lipid oxidation in cell membranes, enhancing cellular integrity and function. Selenium, an essential trace mineral in fish, is a component of selenoproteins with critical antioxidant functions, protecting against oxidative damage and supporting immune function. Additional antioxidants such as coenzyme Q10, found in fish like sardines and mackerel, contribute to cellular energy production while neutralizing free radicals. Glutathione, present in various types of seafood, supports detoxification pathways and bolsters cellular antioxidant defense systems.

This review synthesizes the mechanisms, health benefits, and dietary implications of seafood-derived antioxidants, providing insights into their potential for enhancing human health.

sciforum-110559: Stability of *Cotinus coggygria* Scop. extract-loaded liposomes: the impact of storage on their physical and antioxidant properties

Aleksandra A. Jovanović [1,*], Amjed Abdullah Karkad [2,3], Andrea Pirković [1], Dragana Dekanski [1], Diana Lupulović [1], Miroslav Novaković [4] and Aleksandar Marinković [5]

[1] Institute for the Application of Nuclear Energy INEP, University of Belgrade, Banatska 31b, 11080 Belgrade, Serbia
[2] Faculty of Technology and Metallurgy, University of Belgrade, 11000 Belgrade, Serbia
[3] Faculty of Medical Technology, Elmergib University, Msallata, Libya
[4] Institute of Chemistry, Technology and Metallurgy, National Institute of the Republic of Serbia, University of Belgrade, Njegoševa 12, 11000 Belgrade, Serbia
[5] Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11000 Belgrade, Serbia

Smoke tree (*Cotinus coggygria* Scop., Anacardiaceae family) is an important source of essential oils and extracts, with a wide range of health-promoting effects, such as antioxidant, antibacterial, antigenotoxic, antimicrobial, hepatoprotective, and anti-inflammatory potential. The antioxidant activity of plant products is of great interest due to their ability to preserve food, pharmaceutical, and cosmetic formulations from the toxic and degrading influence of oxidants or free radicals. The encapsulation of various plant extracts within delivery systems can provide prolonged and controlled recovery and protection of their antioxidants. Hence, in the current research, the stability of *C. coggygria* extract-loaded liposomes (non-treated and UV-irradiated) was monitored for 60 days via the impact of storage on their physical and antioxidant properties. The vesicle size, polydispersity index (PDI), and zeta potential were determined using photon correlation spectroscopy in a 60-day storage study at 4 °C. The liposome size varied over a narrow range for the 60 days, from 3131.0±17.0 nm to 3078.0±42.0 nm (for non-treated) and from 2092.0±22.0 nm to 2136.0±37.0 nm (for UV-irradiated). The PDI values obtained were between 0.273±0.089 and 0.313±0.051 (for non-treated) and 0.829±0.074 and 0.911±0.078 (for UV-irradiated). The zeta potential was -28.2±0.4 mV on the 1st day and -29.6 mV on the 60th day for the non-treated sample, while for the UV-irritated liposomes, the zeta potential was -21.5±0.8 mV on the 1st day and -22.0±1.1 mV on the 60th day. The obtained extract-loaded liposomes neutralized 81.9±0.4% of the free DPPH radicals before UV irradiation and 80.9±0.4% after irradiation. In the case of the ABTS assay, UV irradiation also significantly reduced the antioxidant capacity of the extract-loaded liposomes, from 12.02±0.54 µmol Trolox equivalent (TE)/mL to 10.55±0.28 µmol TE/mL. Furthermore, the ABTS and DPPH radicals' scavenging activity of the UV-irradiated liposomes significantly decreased after 60 days of storage (75.4±0.7% and 8.93±0.45 µmol TE/mL, respectively), whereas in the non-treated sample, this drop in antioxidant capacity was not observed.

sciforum-114110: Study of Total Phenolics, Flavonoids and Antioxidant Activity of *Pongamia pinnata* leaves extract

Meenu Verma [1,2,*], Vaishali Mishra [3], Shiwa Chaubey [1], Meenakshi Singh [2] and Mahesh Pal [1]

[1] Phytochemistry Division, CSIR- National Botanical Research Institute, Lucknow- 226001, India.
[2] Department of Chemistry, Isabella Thoburn College, Lucknow -226007, India
[3] Phytochemistry Division, CSIR- National Botanical Research Institute, Lucknow- 226001, India

Pongamia pinnata, commonly known as Karanja, is among the most important species of the family fabaceae, with its diverse medicinal properties. It used to be found only in Asia, but now it can be found in India, Malaysia, Australia, Hawaii, Oceania, Florida, the Philippines, and Seychelles. All parts of the plant have been used for the treatment of several kind of ailments such as piles, skin diseases, and wounds. The leaves can also be utilized to treat diarrhea and cough. Leaf juice is used for relieving rheumatic pains and for cleaning ulcers. Therefore, the aim of present study was to assess the total phenolic content (TPC), total flavonoid content (TFC), and antioxidant properties of various extracts (hexane, chloroform, butanol, methanol) of *Pongamia pinnata* leaves. The screening of the phytochemical profile showed that the chloroform extract had more phytochemicals than the other solvent extracts. These included saponins, terpenoids, phenolic compounds, tannins, glycosides, flavonoids, steroids, and sugar. Among all the extracts, the chloroform extract showed the highest TPC and TFC values, followed by the hexane extract. All the extracts possessed 1,1-diphenyl-2-picryl hydrazyl (DPPH) radical scavenging activity and total antioxidant capacity (phosphomolybdate assay), as well as reducing power, which was supported by the observation of a significant correlation with TPC and TFC. The presence of high TFC and TPC values in the chloroform extract of leaves suggests that they contain a large number of secondary metabolites, but more research is needed to assess the chemical markers. These findings lead us to conclude that chloroform extract has high pharmaceutical value, due to its high antioxidant activity.

sciforum-111788: Sustainable Antioxidants: Exploring Beer By-Products for Cosmetic and Pharmaceutical Applications

Carolina Benera [1,*], Patrícia Branco [2], Adília Charmier [2], Manuela Lageiro [3,4], Catarina Pinto Reis [5,6] and Elisabete Muchagato Maurício [2,7,8]

[1] Faculty of Pharmacy, Universidade de Lisboa, 1649-003 Lisboa, Portugal
[2] BIORG—Bioengineering and Sustainability Research Group, Faculdade de Engenharia, Universidade Lusófona, Av. Campo Grande 376, 1749-024 Lisbon, Portugal
[3] INIAV—Instituto Nacional de Investigação Agrária e Veterinária, Unidade de Tecnologia e Inovação, 2780-157 Oeiras, Portugal
[4] GeoBioSciences, GeoTechnologies and GeoEngineering — NOVA FCT, NOVA University, NOVA School of Science and Technology, 2829-516 Caparica, Portugal
[5] Instituto de Biofísica e Engenharia Biomédica (IBEB), Faculdade de Ciências, Universidade de Lisboa, 1749-016 Lisboa, Portugal
[6] Nanomedicine and Biomedical Imaging Group, Research Institute for Medicines (iMed.ULisboa), Faculty of Pharmacy, Universidade de Lisboa, 1649-003 Lisboa, Portugal
[7] CBIOS—Research Center for Biosciences & Health Technologies, Universidade Lusófona, Campo Grande 376, 1749-024 Lisbon, Portugal
[8] Elisa Câmara, Lda, Dermocosmética, Centro Empresarial de Talaíde, n°7 e 8, 2785-723 Lisbon, Portugal

Beer, a widely consumed carbonated beverage, is made from malted cereal, hops, yeast, and water. Rich in carbohydrates, minerals, vitamins, amino acids, and polyphenols, it provides essential nutrients [1]. However, the brewing process generates significant solid waste, including hot trub, a slurry of wort, hop particles, and coagulated proteins formed during wort boiling [2]. Given the environmental impact of agro-industrial waste, sustainable methods to repurpose these by-products into bio-products are essential. The aim of this study was to evaluate the potential of transforming these by-products into biologically active extracts suitable for use as functional ingredients in cosmetic and pharmacological formulations. The prepared extracts included one alcoholic and one hydroalcoholic extract obtained through Soxhlet extraction, as well as a hydroalcoholic extract prepared via maceration. Antioxidant activity was assessed using the DPPH radical scavenging assay and the ferric reducing antioxidant power (FRAP) method. Additionally, the extracts were analysed for total flavonoid content using the aluminium chloride colorimetric method and total phenolic content using the Folin–Ciocalteu method. The results demonstrated that the different extracts exhibited antioxidant activity, with the alcoholic extract showing the best performance in both methods, obtaining a value of 61.31±0.39 mmol $FeSO_4$/g extract for the FRAP assay and a value of 11.74±0.57 mmol TE/g extract for the DPPH assay. Furthermore, the alcoholic extract displayed the highest levels of total phenolic content (3.66±0.17 mg GAE/g extract) and total flavonoid content (22.61±2.68 mg QE/g extract). These findings suggest that beer wastes could serve as a promising source of natural polyphenolic compounds, offering potential as an eco-friendly antioxidant ingredient. Such compounds could be incorporated into nutraceutical formulations or applied in pharmaceuticals and cosmetics, contributing to waste valorisation and sustainability.

References

1. Costa, Senna et al. (2021). DOI:10.1007/s12649-020-01163-6
2. Thiago, R. et al. (2014) DOI:10.5897/JBD2014.0043

sciforum-111687: Sustainable Recovery of Lignin with Potent Antioxidant Properties from Agrifood Industry By-products by use OF Deep Eutectic Solvents

Rita Argenziano *, Federica Moccia, Lucia Panzella and Alessandra Napolitano

Department of Chemical Sciences, University of Naples "Federico II", Via Cintia 4, I-80126, Naples, Italy

The agri-food industry is responsible for generating high volumes of byproducts, representing a largely available and low-cost source of value-added compounds, including, notably, polyphenolic compounds. Among these, lignin has gained increasing attention as a functional additive in a variety of sectors due to its remarkable antioxidant properties. Despite the promising potential of this complex and heterogeneous polyphenol polymer, its exploitation has remained underexplored, mostly due to difficulties related to its recovery from natural sources, primarily woody materials. Recently, common lignin extraction methods, relying on the use of conventional solvents, have been replaced by efficient, sustainable, and cost-effective deep eutectic solvents (DESs). These solvents are easily prepared by mixing a hydrogen bond acceptor and a hydrogen bond donor to form a new solvent with a melting point lower than those of the individual components. The ability to form hydrogen bonds or to donate/accept protons confers DESs good dissolution properties toward phenolic compounds. In this context, we report herein the application of DESs for the efficient extraction of lignin from natural sources, very rich in this polyphenol polymer. For instance, a combination of ball milling and DES-based treatment proved an effective strategy for lignin recovery from edible nut shells. Following ball milling treatment, shells were treated with 1:2 mol/mol chlorine chloride/lactic acid (ChCl/LA2) as DESs at 120 °C for 24 h, yielding lignin at 19- 27% w/w. The extracted lignin exhibited antioxidant properties, particularly in the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay (EC_{50} values ranging from 0.03 to 0.19 mg/mL). In addition, a full valorization of spent coffee grounds and tomato seeds as source of antioxidant compounds was implemented by developing a DES-based (ChCl/LA2) extraction protocol, allowing for the sequential recovery of low-molecular-weight phenols and lignin. The examples that will be presented showcase the potential of lignin as natural antioxidant compound for different applications.

sciforum-114162: The antioxidant potential of *Arbutus unedo* tree berries from the Natural Park of Montesinho

Mariana Lamas [1,*], Ana Margarida Silva [1], Manuela M. Moreira [1], Cristina Delerue-Matos [1], Maria Helena Amaral [2,3], Virgínia Cruz Fernandes [1,4,5] and Francisca Rodrigues [1]

[1] REQUIMTE/LAQV, ISEP, Polytechnic of Porto, Rua Dr. António Bernardino de Almeida, 431,4249-015 Porto, Portugal
[2] UCIBIO – Applied Molecular Biosciences Unit, MEDTECH, Laboratory of Pharmaceutical Technology, Department of Drug Sciences, Faculty of Pharmacy, University of Porto; 4050-313 Porto, Portugal
[3] i4HB – Institute for Health and Bioeconomy, Faculty of Pharmacy, University of Porto, 4050-313 Porto, Portugal
[4] Chemical and Biomolecular Sciences, School of Health, Polytechnic of Porto, Rua Dr. António Bernardino de Almeida 400, 4200-072 Porto, Portugal
[5] RISE-Health, Center for Translational Health and Medical Biotechnology Research (TBIO), ESS, Polytechnic of Porto, Rua Dr. António Bernardino de Almeida, 400, 4200-072, Porto, Portugal

---

Arbutus unedo L. is a native species of the Mediterranean region, commonly known as strawberry tree [1]. Traditionally, this species has been used for medicinal purposes [2], and the berries are not usually directly consumed but instead used for the production of alcoholic beverages and jams [3]. Strawberry tree berries are noted for their impressive nutritional profile, being rich in different bioactive compounds [2], which underpins their various pharmacological properties [4], such as antioxidant activity, drawing the attention of food, nutraceutical, and cosmetic industries [5].

This study's goal is to develop an eco-friendly extract from A. unedo L. berries using a green approach. Briefly, in October 2022, berries were collected from Natural Park of Montesinho and then processed using an ultrasound-assisted extraction (UAE), using water as solvent and with an extraction intensity of 30 W/m². The impact of extraction time (15–90 minutes) was assessed on the total phenolic content (TPC), in vitro antioxidant/antiradical activities, reactive oxygen species (ROS) scavenging capacity, phytochemical profile, and keratinocytes viability.

The results highlighted that the 60-min extract exhibited, overall, the highest values for the antioxidant/antiradical activities (ABTS = 30.36 mg AAE/g dw; DPPH = 43.83 mg TE/g dw; FRAP = 415.61 μmol FSE/g dw) and TPC (30.27 mg GAE/g dw). Concerning the ROS scavenging capacity, this extract's IC50 values for hypochlorous acid and superoxide radical were 19.78 and 90.51 μg/mL, respectively, and 0.19 μmol TE/mg dw for peroxyl radical. The analysis of the phytochemical profile highlighted significant levels of gallic acid, catechin, and its derivatives. Moreover, the keratinocyte viability was higher than 90% after exposure to the highest concentration tested (1000 μg/ml). These findings highlight the potential of UAE-extracted A. unedo L. fruit as a valuable source of bioactive compounds suitable for use as an active ingredient in different industries.

Acknowledgments: This research was funded by MTS/SAS/0077/2020—Honey+—New reasons to care honey from the Natural Park of Montesinho: A bioindicator of environmental quality & its therapeutic potential, and by the projects UIDB/50006/2020, UIDP/50006/2020, and LA/P/0008/2020, all supported by Fundação para a Ciência e a Tecnologia (FCT)/Ministério da Ciência, Tecnologia e Ensino Superior (MCTES). This work was also financed by national funds from FCT—Fundação para a Ciência e a Tecnologia, I.P., in the scope of the project UIDP/04378/2020 and UIDB/04378/2020 of the Research Unit on Applied Molecular Biosciences—UCIBIO and the project LA/P/0140/2020 of the Associate Laboratory Institute for Health and Bioeconomy—i4HB. Ana Margarida Silva is thankful for the Ph.D. grant (SFRH/BD/144994/2019) financed by POPH–QREN and subsidized by the European Science Foundation and Ministério da Ciência, Tecnologia e Ensino Superior. F. Rodrigues (2023.06819.CEECIND) and M. Moreira (2023.05993.CEECIND) are thankful for their contracts financed by FCT/MCTES.

References

1. Macchioni, V., V. Santarelli, and K. Carbone, Phytochemical Profile, Antiradical Capacity and α-Glucosidase Inhibitory Potential of Wild Arbutus unedo L. Fruits from Central Italy: A Chemometric Approach. Plants (Basel), 2020. 9(12).
2. El Haouari, M., et al., An Insight into Phytochemical, Pharmacological, and Nutritional Properties of Arbutus unedo L. from Morocco. Evid Based Complement Alternat Med, 2021. 2021: p. 1794621.
3. Oliveira, I., et al., Volatile profile of Arbutus unedo L. fruits through ripening stage. Food Chemistry, 2011. 128: p. 667-673.
4. Ben Salem, I., et al., Exploring the nutraceutical potential and biological activities of Arbutus unedo L. (Ericaceae) fruits. Industrial Crops and Products, 2018. 122.
5. Martins, J., G. Pinto, and J. Canhoto, Biotechnology of the multipurpose tree species Arbutus unedo: a review. Journal of Forestry Research, 2021. 33.

sciforum-116258: Unveiling the biochemical potential of Romanian soybean genotypes: a focus on antioxidant properties

Edward Muntean [1,*], Urda Camelia [2] and Raluca Rezi [2]

[1] Department of Food Science, Faculty of Food Science and Technology, University of Agricultural Sciences and Veterinary Medicine Cluj Napoca, Cluj Napoca, 400372, Romania
[2] Research & Development Station for Agriculture, Turda, Romania

Soybean seeds are recognized as a valuable agricultural and nutritional resource, primarily because they are an excellent source of proteins. Beyond their nutritional benefits, soybeans host a remarkable array of bioactive compounds that add significant health benefits, including fatty acids, carbohydrates, isoflavones, saponins, phytosterols, lectins, phytic acid, and carotenoids. Many of these compounds exhibit antioxidant properties, and knowing their content is important because they can offer potential health benefits that extend beyond basic nutrition, enabling broader applications in nutraceuticals and functional foods. Recognizing the significance of these compounds, it becomes essential to explore their presence and variation across different soybean genotypes, as such insights can guide the development of nutritionally enhanced soy-based products and support their application in health-focused industries. In this context, the present study examined soybean seeds from 18 commercial Romanian genotypes, harvested at maturity from the Research & Development Station for Agriculture in Turda, Romania; total phenols were determined based on the Folin–Ciocalteu, assay with results expressed in gallic acid equivalents (GAEs). Total flavonoid content was determined spectrophotometrically and reported as catechin equivalents (CEs), and total carotenoids were also quantified using spectrophotometry, with results expressed in mg/kg. The findings revealed a relatively narrow range of variation in the concentrations of total phenols, which ranged between 1.66 and 1.98 mg GAE/g, indicating consistent phenolic content across the studied genotypes; similarly, total flavonoids exhibited a variation from 19 to 32 µg CE/kg, suggesting moderate differences in flavonoid levels. Total carotenoids ranged from 9.46 to 15.43 mg/kg, highlighting a slightly broader variability. These results underscore the stable yet distinct biochemical profiles of the evaluated soybean genotypes, providing valuable insights into their potential for functional food and nutraceutical development and enabling researchers and food technologists to optimize soy-based products, enhancing their health-promoting benefits and broadening their applications in addressing nutritional and wellness needs.

sciforum-114171: Use of sprouting to modify the antioxidant activity and phenol content of *Inga paterno* seed flour

Lizbeth Rosas-Ordoñez [1,*] and Taisa S.S. Pereira [2]

[1] Department of Chemical, Food and Environmental Engineering, Universidad de las Américas Puebla, Puebla, 72810, Mexico
[2] Department of Health Sciences, Universidad de las Américas Puebla, Puebla, 72810, Mexico

Inga paterno is an underutilized legume whose seeds are a good source of protein. However, the cottony sarcotesta is the most consumed part of the plant. Given that sprouting has been shown to enhance the nutritional value of legumes, this study investigated how sprouting duration influences the total phenolic content (TPC) and antioxidant activity (TAC) of *I. paterno* seed flour.

I. paterno seeds were sprouted at 23°C with 78% RH for 0, 2, 4, 6, 8, or 10 days. The sprouted seeds were ground into flour. Then, each flour was mixed with methanol solution (20:80), stirred at 25°C for 24 hours, and centrifuged to obtain the supernatant. TPC and TAC were determined by the Folin–Ciocalteu method and DPPH• or ABTS•+ radical scavenging assays, respectively. One-way ANOVA and Tukey's test were used to analyze the data ($p \leq 0.05$).

TPC exhibited a range of 5.54 to 12.09 mg gallic acid equivalents per gram of dry matter (dm), with a significant increase after 4, 6, 8, and 10 days of sprouting. DPPH-based TAC values ranged from 4.28 ± 0.11 to 9.87 ± 0.14 μM Trolox equivalents (TE) per gram of dm, while ABTS-based TAC values ranged from 17.41 ± 0.51 to 26.40 ± 0.50 μM TE per gram of dm. Significant increases in DPPH-based TAC were observed after the 4th day and at all subsequent sprouting times, while ABTS-based TAC significantly increased after the 2nd and 8th days of sprouting. The observed changes may be attributed to the breakdown of phenolic compounds bound to plant cell walls, as well as to the activation of metabolic pathways that modify antioxidant metabolites.

This study demonstrates that sprouting *I. paterno* seeds for 4 days enhances the nutritional value of the resulting flour. However, further investigation is necessary to evaluate other potential nutritional modifications fully.

sciforum-111748: Valorization of rice straw through aqueous polyphenol extraction: Optimization, scale-up and potential industrial applications.

José Ramón Martínez Guillén *, Francisco Javier Álvarez Martínez, María Herranz López, Vicente Micol Molina and Enrique Barrajón Catalán

[1] Institute of Research, Development, and Innovation in Healthcare Biotechnology of Elche (IDiBE)
[2] Instituto de Investigación, Desarrollo e Innovación en Biotecnología Sanitaria de Elche, Universidad Miguel Hernández de Elche, Elche (Alicante) , 03202, Spain

This study explores the optimization and scale-up of polyphenol extraction from rice straw (*Oryza sativa*), a lignocellulosic by-product with significant environmental impact. Annually, up to 790 million tons of rice straw are generated worldwide, much of which is improperly disposed of, often through open burning. On the one hand, this practice releases harmful gases, detrimentally affecting environmental quality and human health. On the other hand, the high antioxidant and antimicrobial value of rice straw-derived polyphenols presents a promising solution for repurposing this waste, aligning with circular economy principles.

To maximize the recovery of these bioactive compounds, artificial intelligence was utilized to optimize critical extraction parameters, including temperature, ultrasound energy (J/mL), enzyme quantities and straw-to-water ratios. Laboratory-scale optimization identified conditions yielding high polyphenolic content and antioxidant capacity.

Progressing to a semi-industrial scale, advanced technologies such as steam explosion and affinity resin purification were employed. Equipment such as semi-industrial reactors, plate filters, rotary evaporators and vacuum dryers were integrated to refine and scale the process.

Following the optimization of the scaling-up process, different assays were conducted to determine the polyphenolic content, antioxidant capacity and cosmetic potential of the obtained extracts. The results of these tests confirmed the scalability and industrial feasibility of the aqueous extraction method. The residues and by-products of this process have been also valorized for alternative industrial and value-added applications, adhering to the principles of circular economy and sustainable development.

In this sense, the obtained polyphenol-rich extract demonstrated potential for incorporation into anti-aging cosmetic formulations and as additives in footwear components. Additionally, residual by-products from the process were successfully repurposed into biomaterials for construction applications, further enhancing the sustainability of the system.

sciforum-111478: Wines from honey-fermented orange juice possess antioxidant properties

Ivan Cruz-Chamorro [1,2,*], Eva-María Valero-Blanco [1], Rocío Rodríguez-Arcos [3], Justo Pedroche [4], Guillermo Santos-Sánchez [5], Isabel Cerrillo [6], Blanca Escudero-López [1] and María-Soledad Fernández-Pachón [6]

[1] Área de Nutrición y Bromatología, Departamento de Biología Molecular e Ingeniería Bioquímica, Universidad Pablo de Olavide, Ctra. Utrera Km 1, 41013 Seville, Spain
[2] Facultad de Enfermería, Universidad de Castilla-La Mancha, 02071 Albacete, Spain
[3] Grupo Fitoquímicos y Calidad de los Alimentos, Instituto de la Grasa-CSIC, 41013 Seville, Spain
[4] Department of Food & Health, Instituto de la Grasa, CSIC, Ctra, Utrera Km 1, 41013 Seville, Spain.
[5] Instituto de Investigación en Ciencias de la Alimentación, CIAL (CSIC-UAM), 28049 Madrid, Spain
[6] Área de Nutrición y Bromatología, Departamento de Biología Molecular e Ingeniería Bioquímica, Universidad Pablo de Olavide, Ctra. Utrera Km 1, 41013 Sevilla, Spain

Orange juice (OJ) contains a wide range of micronutrients and phytochemicals that have been found to exhibit preventive effects against the onset of several diseases. Moreover, alcoholic fermentation improves its content of bioactive antioxidant compounds. Thus, fermented orange juice (FOJ) with organic honey was finally investigated to obtain a demi-sec wine (dSW) and sec wine (SW). Sauro Giannini carried out this process at Cantina CITRO. Oxidative stress is responsible for the onset and progression of many chronic pathologies, including neurodegenerative diseases, cardiovascular diseases, cancer, diabetes, and obesity.

Thus, this study aimed to assess the antioxidant capacity of these new organic products to provide scientific evidence of their possible health benefits.

Using colorimetric assays, ferric reducing antioxidant power (FRAP) and ABTS radical scavenging activity (ARSA) were tested to provide information about the global antioxidant capacity. Moreover, the content of total polyphenols was evaluated. In addition, two principal polyphenols (tyrosol and hydroxytyrosol) were quantified by means of mass spectroscopy. Also, melatonin and its precursor tryptophan were quantified.

Although FOJ showed the best antioxidant capacity (FRAP: +24.30%; ARSA: +18.40%), SW increased the antioxidant activity (FRAP: +17.30%; ARSA: +6.20%), followed by dSW (FRAP: +16.60%; ARSA: +0.5%). This increase correlated positively with the polyphenol content (*vs*. FRAP: r = +0.872; *vs*. ABTS radical: r = −0.945). When polyphenols were quantified, both wines showed an increase in tyrosol (SW: 10.33 ng/mL; dSW: 12.57 ng/mL) and hydroxytyrosol (SW and dSW: 0.02 ng/mL) compared to the OJ. Finally, the fermentation consumed the tryptophan to synthesize the melatonin, whose values were maintained in both wines (≈ 20ng/mL). Melatonin is a ubiquitous molecule that is involved in numerous biological functions and is a well-known potent scavenger of reactive oxygen species.

In conclusion, these new wines from organic honey-fermented orange juice possess antioxidant capacity.

MDPI AG
Grosspeteranlage 5
4052 Basel
Switzerland
Tel.: +41 61 683 77 34

Antioxidants Editorial Office
E-mail: antioxidants@mdpi.com
www.mdpi.com/journal/antioxidants


MDPI