Book of Abstracts

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Abstract Index

Oral presentations: 28 | Poster presentations: 18 (Duplicate submissions selected for oral presentation are listed only under Oral Presentations.)

Oral Presentations

Code	Presenting author / first author	Title
O01	Irene Rinaldi	Neuroprotective effects of oleocanthal in Drosophila models of Parkinson's disease
O02	Anna Mazzierli	Cranberry juice (CJ) counteracts the inflammatory process in activated human microglial HMC3 cell line
O03	A. Massaro	Kumquat Fruit Administration Counteracts Dysmetabolism-Related Neurodegeneration and the Associated Brain Insulin Resistance in the High-Fat Diet-Fed Mice
O04	Melissa Zannini	Role of dietary phenolic compounds and their gut microbial metabolites in supporting chemotherapy in colorectal cancer
O05	Graziella Serio	PROTECT-CRC: Polyphenol-Rich Pistachio Extracts in CRC Prevention
O06	Giovanni Pratelli	Methyl gallate, a promising nature-inspired bioactive compound, triggers an iron-dependent cell death in breast cancer cells.
O07	Alessandro, Maugeri	Oxidative stress is unleashed by a flavonoid-rich extract of bergamot juice in colorectal cancer models
O08	Valentina Vassallo	Combined Mediterranean Bioactives Modulate Lipid Metabolism and Inflammation in an In Vitro NAFLD Model
O09	Maria Russo	Low-Dose Phenolic Compounds Delivered by Nanoemulsion Enhance Antioxidant Responses via Plasma Membrane Redox System Activation in Differentiated Cells
O10	Federica Davì	Targeting mitochondrial dysfunction in fibromyalgia: effects of Spirulina platensis on PGC-1α signaling and redox homeostasis
O11	Giuseppe Conti	Pistachio Leaf Extract Promotes Redox-Dependent Mitochondrial Adaptation and Metabolic Responses in Ethanol-Stressed HepG2 Cells
O12	E. La Spina	Icariin and Baicalin improve post exercise recovery by enhancing bioenergetic efficiency and adaptive stress response in zebrafish larvae
O13	Alessia Boatta	THE HIDDEN SIDE OF SPORT PERFORMANCE: THE SCREENING OF THE FEMALE ATHLETE TRIAD
O14	Giuseppe T. Patanè	From diet to endocrine function: cyanidin-3-O-glucoside modulates PKA signalling, metabolism, and androgen synthesis in Leydig cells
O15	Alessia Silla	Luminescent Bioanalytical Platforms for Exploring New Biomarkers in Nutrition And Human Health Within Complex Biological Matrices.
O16	Simona Reina	Exploring the Nutrigenomic Potential of Broccolo nero: Multi-Omics Insights into Epigenetic Modulation and Anti-Inflammatory Signalling
O17	M. La Chimia	Targeting the Metabolic-Epigenetic Axis in Breast Cancer: The Role of DJ-1 and Histone Glycation
O18	Federica, Tonolo	Valorization of Whey through a Fermented Functional Food Enriched with Milk-Derived Bioactive Peptides for the Prevention of Intestinal Inflammatory Disorders
O19	Giovanni Ricci	VALORIZATION OF COFFEE SILVERSKIN: FROM BYPRODUCT TO FUNCTIONAL INGREDIENT
O20	Giulia Feliziani	Food matrix modulates antioxidant bioaccessibility and intestinal barrier protection: enhanced effects in pigmented wheat pasta compared to bread
O21	Sonia Lorrai	Antioxidant and Phenolic Content of Sardinian Fabaceae Cultivars: Influence of Extraction Methods and Species Variability
O22	Regina Aparo	Polyphenolic Extract from Thinned Apples Accelerates Cutaneous Wound Healing by Targeting Oxidative Stress Pathways, Angiogenic Responses, and Fibrotic Processes in Diabetic versus Non-Diabetic States
O23	Susan Mirmaijdi	CIRCULATING AND PLASMA SIGNALING LIPID PROFILING IN MATERNAL OBESITY AND GESTATIONAL DIABETES
O24	Zeudi Petrone	Diabetes-induced metabolic stress drives corneal neuropathy: protective effects of a multicomponent ophthalmic formulation in a chick embryo model.
O25	Alessandro Massaro	Dietary phytochemical Indicaxanthin modulates NF-κB signaling in IL-1β-activated human synovial fibroblasts: integration of biochemical and biased molecular dynamics approaches
O26	Francesco Tancredi	Methylene blue removal from aqueous solutions by alginate@chitosan beads containing microbial melanin
O27	Stefano Putaggio	Oxidative and metabolic profile of human red blood cells in the presence of bisphenol B
O28	Chiara Rucci	Exploring the anti-inflammaging potential of a callus extract from a heritage Italian apple variety: a multiomic approach

Poster Presentations

Code	Presenting author / first author	Title
P01	Rosalia Pellitteri	Natural antioxidant effect on tissue transglutaminase levels in glial olfactory cells exposed to amyloid-β: Integrated Biochemical and Computational study
P02	Maria Cristina Barbalace	Dose- and Time-Dependent Effects of Perfluorobutane Sulfonic Acid on Microglial Cells
P03	Sandra Buratta	Effects of burned and heated cigarette smoke extracts on oxidative stress and extracellular vesicle biochemical cargo in bronchial epithelial cells
P04	Chiara Zalambani	Upcycled Potato Peel Bioactives Modulate Stress Responses and Enhance Recovery in Human Keratinocytes
P05	Federica Affranchi	Green Extraction and Circular Valorisation of Grape Pomace: A Sustainable Source of Bioactive Compounds with antioxidant potential for Nutraceutical Applications
P06	Federico Barrino and Federica Giuliano	Active Biodegradable Packaging Based on PBS and Natural Oils: Improved Oxidative Stability and Shelf Life of Fresh-Cut Fruits
P07	Pier Luigi Lombardi	Investigating the bone tissue differentiation potential of plumbagin in Dental Pulp Stromal/Stem Cell Cultures
P08	Giovanni Ricci	PROTECTIVE ROLE OF HUMAN AND BOVINE MILK GLYCOSAMINOGLYCANS AGAINST METHYLGLYOXAL-INDUCED GLYCO-OXIDATIVE DAMAGE IN INTESTINAL CELLS
P09	Greta Gozzi	Bioluminescent Yeast Biosensor for the Quantification of Urinary Caffeic Acid as Biomarker of Dietary Polyphenols Intake
P10	Carmen Chiaradia	Impact of Extra Virgin Olive Oil Polyphenols on Skeletal Muscle under Stress and Inflammation
P11	Roberta Oliveri	A Novel Food-Derived Bioactive Extract Attenuates Lipid Accumulation in a Steatotic HepG2 Cell Model via AMPK Activation
P12	Maria Ronsivalle	Natural Whey Starter-Derived Lactobacillus helveticus as a Source of Bioactive Peptides for Functional Fermented Milk
P13	Aiello V	Protective role of Tuber Borchii extracts against galactose-induced skeletal muscle sarcopenia in C2C12 myotubes.
P14	Valeria, Consoli	Menadione Hormetic Regulation of Ferroptosis in Breast Cancer
P15	Giorgia Centamore	Targeting Lipid Metabolism to Modulate Ferroptosis in Breast Cancer
P16	Maddalena De Angeli	Mechanistic Insights into Gut Microbial Metabolites of Phenolic Compounds in Colorectal Cancer Revealed by Metabolomic Analysis
P17	Gaia Nicotra	Stage-dependent epigenetic and anti-inflammatory effects of sprouts, microgreens, and baby leaves of Broccolo nero: a multi-omics perspective for sustainable nutrition
P18	Mahsa Karimi	Framework for proteome analysis of cyanobacteria biofilm shaped in hydrogel scaffold

Oral Presentations

O01 Oral Presentation

Neuroprotective effects of oleocanthal in Drosophila models of Parkinson's disease

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Parkinson's disease (PD) is characterized by progressive dopaminergic neuron loss associated with α-synuclein aggregation and chronic neuroinflammation. This inflammatory component plays a key role in disease onset and progression and represents a promising therapeutic target. We recently found that oleocanthal (OL), a phenolic compound from extra virgin olive oil, exerts strong and pleiotropic anti-neuroinflammatory effects in vitro [1], highlighting its relevance in inflammation-related disorders. On these premises, this study aimed to investigate the potential neuroprotective activity of OL in Drosophila melanogaster models of PD. Flies expressing α-synuclein under the control of the pan-neuronal drivers embryonic lethal abnormal vision (elav) or neuronal synaptobrevin (nsyb) were employed. Newly eclosed males and females were separated and exposed to OL via food supplementation throughout their lifespan. At 30 days post-eclosion, locomotor activity was assessed by negative geotaxis assay. Furthermore, dopaminergic neurons of the protocerebral posterior lateral 1 (PPL1) cluster were quantified in dissected brains from thirty-day-old flies by immunostaining and confocal microscopy. OL significantly improved the climbing performance of α-synuclein-expressing flies, indicating a beneficial effect on locomotor function. Interestingly, it also effectively counteracted the α-synuclein-driven loss of dopaminergic neurons in the PPL1 cluster, suggesting a neuroprotective effect. These preliminary results in Drosophila PD models show that OL modulates key pathological features in vivo, supporting its preventive and therapeutic potential. However, validation in additional PD models is required, and OL mechanisms of action, as well as its ability to cross the blood-brain barrier, remain to be clarified.

O02 Oral Presentation

Cranberry juice (CJ) counteracts the inflammatory process in activated human microglial HMC3 cell line

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Neuroinflammation plays an important role in the pathogenesis of a wide variety of Central Nervous System (CNS) disorders. Inflammatory stimuli induce microglial activation, leading to the release of pro-inflammatory cytokines and reactive oxygen species (ROS), which exacerbate neuronal damage [1]. Nutraceuticals have gained attention for their anti-inflammatory profile, with cranberry representing a rich source of bioactive compounds with well documented health benefits [2].

This study investigated whether pretreatment with CJ interferes with inflammatory response in human microglia cells (HMC3) exposed to different inflammatory stimuli, including LPS/TNF-α and β-amyloid stimulation.

Our results showed that in LPS/TNF-α-stimulated HMC3 cells, pretreatment with CJ (3mg/mL) significantly reduced the release of pro-inflammatory IL-6 ($p<0.05$) while enhancing the secretion of anti-inflammatory IL-10 ($p<0.005$), indicating an anti-inflammatory effect, further supported by the inhibition of NF-κB signaling pathway and the modulation of microglia activation markers expression. In addition, a reduction of intracellular ROS levels was also observed. In HMC3 cells exposed to Aβ25-35, pretreatment with CJ revealed to efficiently prevent β-amyloid induced cytotoxicity and neuroinflammation.

In a second set of experiments, we developed a co-culture model to explore a possible neuroinflammatory crosstalk between microglia and astrocytes. Indeed, preliminary results indicated that LPS/TNF-α induced HMC3 cells were able to affect human astrocytes (SVGp12) homeostasis, inducing a pro-inflammatory phenotype. Ongoing experiments are providing additional useful insights.

O03 Oral Presentation

Kumquat Fruit Administration Counteracts Dysmetabolism-Related Neurodegeneration and the Associated Brain Insulin Resistance in the High-Fat Diet-Fed Mice

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Metabolic disorders and brain insulin resistance (IR) are major risk factors for the development of neurodegenerative conditions. Kumquat fruit (KF) administration has demonstrated significant anti-dysmetabolic effects, improving peripheral IR in murine models of metabolic syndrome. Along these lines, this study evaluated the neuroprotective effects of KF supplementation in a model of dysmetabolism-induced neuronal damage and its ability to counteract the disruption of brain insulin signalling. To this end, biochemical and histological analysis assessed neuroapoptosis, disruption of brain insulin signalling and neuroinflammation in a model of high-fat diet (HFD)-induced neuronal damage. Our findings demonstrate, for the first time, that KF supplementation significantly counteracts HFD-induced neuroapoptosis downregulating pro-apoptotic genes (FAS-L, BIM and P27) and upregulating the anti-apoptotic ones (BDNF and BCL-2). Coherently, KF positively influenced the expression of selected genes related to Alzheimer's Disease. Relevantly, these effects were associated to KF ability to restore brain insulin signalling by increasing insulin receptor expression, reducing IRS-1 serine phosphorylation, enhancing both AKT activation and GSK-3β inactivation. Accordingly, KF suppressed HFD-neuroinflammation, counteracting the overexpression of NF-κB and its downstream enzymatic products, iNOS and COX-2. Collectively, these findings demonstrate the neuroprotective benefits of KF administration, supporting its potential as a dietary intervention for dysmetabolic-related neurodegenerative disorders.

O04 Oral Presentation

Role of dietary phenolic compounds and their gut microbial metabolites in supporting chemotherapy in colorectal cancer

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Colorectal cancer (CRC) is one of the most common cancers worldwide. Increasing evidence highlights the role of diet and phenolic compounds in CRC onset and prevention. Following gastrointestinal digestion, phenolic compounds reach the colon, where they are metabolized by gut microbiota into low molecular weight bioactive compounds, some of which exhibit anti-proliferative activity in colon cancer cell lines [1]. Among colon cancers cells, SW480 represents an advanced tumour stage cell line and is resistant to 5-fluorouracil (5-FU), a widely used drug in CRC therapy [2].

This study aimed to evaluate whether gut-derived phenolic metabolites can inhibit the growth of SW480 cells, either alone or in combination with 5-FU, enhancing cellular sensitivity to 5-FU. Additionally, the effects of these compounds, alone or in combination with 5-FU, on cell cycle, apoptosis, and reactive oxygen species production were assessed.

First, the anti-proliferative activity of several colonic metabolites was screened and their IC50 values were determined. The most active compounds were gallic acid, hesperetin, eriodictyol and naringenin. These compounds mainly acted by blocking the cell cycle. Subsequently, the combined effect of these metabolites with 5-FU was assessed. The combination significantly reduced the IC50 of 5-FU compared with 5-FU alone and enhanced its effect on cell cycle progression, leading to S-phase arrest and, in some cases, also G1 arrest.

In conclusion, a diet rich in phenolic compounds may enhance chemotherapy efficacy, supporting the development of personalized nutritional approaches in oncology.

O05 Oral Presentation

PROTECT-CRC: Polyphenol-Rich Pistachio Extracts in CRC Prevention

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Colorectal cancer (CRC) is one of the most common cancers worldwide and a major public health challenge, requiring innovative preventive and therapeutic strategies due to the limitations of conventional treatments. Nut consumption is associated with reduced CRC risk through modulation of redox-sensitive pathways; however, evidence on pistachios (Pistacia vera) remains limited despite their antioxidant and anti-inflammatory properties. Among varieties, Bronte pistachios show particularly high functional value, with phenolic content up to fourfold higher than major cultivars.

This study investigates the potential of Bronte pistachio in CRC prevention and treatment. Extraction procedures were optimized to maximize bioactive compounds. A 70% ethanol extract (BPE) showed the highest polyphenol content and antioxidant capacity and was fractionated into A-BPE (82.9% w/w), B-BPE (6.5% w/w), and C-BPE (10.7% w/w), with B-BPE richest in antioxidant polyphenols.

Antiproliferative activity was assessed by MTT assay in CRC cell lines (Caco-2, HT-29, HCT-116). A-BPE and B-BPE showed dose- and time-dependent growth inhibition, while C-BPE was inactive, with strongest effects in HCT-116 cells. B-BPE exhibited GI_{50} values about one order of magnitude lower than A-BPE, reaching low µg FW/mL at 48 h.

HPLC analysis showed A-BPE enriched in glycosylated flavonoids and anthocyanins, while B-BPE contained flavonoids, chalcones, and oligomeric proanthocyanidins. Consistently, B-BPE induced high cell death (80–90%) in HT-29 and HCT-116 cells, with caspase-3 activation in HCT-116 and autophagy involvement (increased LC3 II/I) in other lines. Finally, extracts modulated key pathways in tumor progression (NF-κB, Wnt/β-catenin, PI3K/Akt, ERK), with stronger effects for B-BPE.

Acknowledgments

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O06 Oral Presentation

Methyl gallate, a promising nature-inspired bioactive compound, triggers an iron-dependent cell death in breast cancer cells.

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Nature-inspired bioactive compounds form a dynamic intersection between nutrition, pharmacology, and environmental science, illustrating how natural ecosystems sustain both human health and planetary balance. Derived from plants, fungi, algae, marine organisms and microorganisms, these molecules often play dual roles—as nutrients that support physiological function and as bioactive agents that modulate metabolic, immune, and signaling pathways.

In this study, we examined the anticancer properties of methyl gallate (MG), a natural compound widely represented in vegetal world, in MDA-MB-231 triple-negative breast cancer cells and estrogen responsive MCF7 cells. Our results demonstrated that MG significantly reduced cell viability in a dose- and time-dependent manner, accompanied by an early increase in reactive oxygen species (ROS) production. The cytotoxic and ROS-mediated effects of MG were partially mitigated by the antioxidant N-acetyl-L-cysteine (NAC). This protective effect coincided with the activation of the Keap1/Nrf2 signaling pathway and the upregulation of MnSOD, catalase and HO-1.

Pre-treatment with ferrostatin-1 (FRS), a ferroptosis inhibitor, attenuated the cytotoxic impact of MG, suggesting the involvement of an iron-dependent cell death mechanism. Western blot analyses supported this hypothesis, showing that MG decreased the expression of FTH1 and GPX4, two key regulators of ferroptosis, and that this reduction was reversed upon treatment with either FRS or NAC. Moreover, MG induced iron overload acting as a key driver event for loss of mitochondrial membrane potential, lipid peroxidation and glutathione depletion—all hallmark events driving ferroptotic cell death.

Collectively, building on these mechanistic foundations these findings indicate that the impairment of redox homeostasis and iron-dependent cytotoxicity dictates MG anti-tumor activity in breast cancer cells, supporting the potential of natural compounds as complementary therapeutic agents.

O07 Oral Presentation

Oxidative stress is unleashed by a flavonoid-rich extract of bergamot juice in colorectal cancer models

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Colorectal cancer (CRC) is the second most common cause of cancer death in the industrialised world, after lung cancer. Evidence suggests that a flavonoid-rich diet may lower the risk of certain forms of cancer, including CRC. The aim of this study was to demonstrate the potential the anti-proliferative effects of a flavonoid-rich extract of bergamot juice (BJe) in CRC models, assessing the underlying mechanisms. In this study, we observed that BJe inhibited the growth of several CRC cells, especially HCT-116. In this cell line, BJe was able to induce both early and late apoptosis, along with block cell cycle in G1 phase. This effect was coupled with a modulation of pro- and anti-apoptotic markers, as well as cell cycle-related factors. Investigating the potential mechanisms, we observed that BJe was able to prompt the production of reactive oxygen species and, consequently, impair the mitochondrial membrane potential. Diving deeper into molecular events, we found that BJe was able to induce DNA damage as demonstrated by the increase of levels of the oxidized nucleobase 8-oxo-2'-

deoxyguanosine, as well as phosphorylation of histone H2A.X, known marker of double-strand breaks. In the azoxymethane-induced murine model of sporadic CRC, oral administration of BJe was able to reduce the number of aberrant crypt foci, as well as the percentage of mice bearing both polyps and tumors, together with their number. Our study highlights the role of BJe as modulator of CRC cell death both in vitro and in vivo, strengthening the knowledge on the underlying mechanism of action.

O08 Oral Presentation

Combined Mediterranean Bioactives Modulate Lipid Metabolism and Inflammation in an In Vitro NAFLD Model

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Non-alcoholic fatty liver disease (NAFLD) is a growing metabolic disorder with no effective pharmacological treatments, highlighting the need for innovative and sustainable nutritional strategies. Mediterranean diet bioactives, known for their antioxidant and anti-inflammatory properties, represent promising modulators of metabolic dysfunction [1]. Accordingly, this study focused on selected Mediterranean dietary bioactives, namely carvacrol and thymol (from oregano and thyme), basil extract, and lycopene (from tomato), in a physiologically relevant in vitro HepG2 steatosis model [2]. In steatotic HepG2 cells, selected treatments displayed antioxidant activity, as confirmed by ABTS and DPPH assays, and significantly reduced intracellular lipid accumulation and lipid peroxidation, as demonstrated by Oil Red O staining, immunofluorescence, and TBARS tests. Mechanistically, bioactive combinations modulated key regulators of lipid metabolism (PPARα, PPARγ, CPT1, ATGL), promoting β-oxidation and improving lipid handling. In parallel, 5-lipoxygenase (5-LOX) expression was downregulated, supporting attenuation of pro-inflammatory signaling. Notably, combined treatments consistently outperformed single compounds across metabolic and inflammatory endpoints. Overall, these findings support multi-target nutraceutical strategies for NAFLD management and warrant further validation in 3D models.

O09 Oral Presentation

Low-Dose Phenolic Compounds Delivered by Nanoemulsion Enhance Antioxidant Responses via Plasma Membrane Redox System Activation in Differentiated Cells

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Intrinsic and extrinsic factors, including oxidative stress, inflammation, aging, pollution, lifestyle, and diet, may induce homeostatic imbalance and contribute to chronic diseases [1].

Dietary phytochemicals may counteract pro-oxidant damage, but these effects are rarely confirmed in clinical trials, likely due to high doses used and their poor bioavailability. Our recent research has demonstrated that low doses of curcumin and sulforaphane (1 μM) protect HL-60 and K-562 cells from H_2O_2-induced toxicity through Nrf2 activation, increasing expression of proteins regulating the cellular antioxidant response, such as HO-1 and NQO1 [2-3].

Here, we assessed cell viability, reactive oxygen species (ROS) production, and HO-1/NQO1 expression after treatment with quercetin, resveratrol, and curcumin at chemopreventive doses in differentiated HT-29 and HL-60 cells, which mimic human enterocytes and monocytes, respectively. In addition, we demonstrated that when delivered via a novel nanoemulsion formulation, these compounds are efficiently absorbed and exert protective effects mainly via activation of the Plasma Membrane Redox System [4]. This approach may offer a theoretical basis for developing effective nutraceuticals to protect vulnerable populations from oxidative stress in polluted environments.

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O10 Oral Presentation

Targeting mitochondrial dysfunction in fibromyalgia: effects of Spirulina platensis on PGC-1α signaling and redox homeostasis

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Fibromyalgia (FM) is a chronic pain condition characterized by mitochondrial dysfunction, redox imbalance, and impaired neuronal signaling. Mitochondrial dysfunction may contribute to the metabolic and inflammatory alterations. This study evaluated whether Spirulina platensis (SP), a cyanobacterium rich in antioxidant and anti-inflammatory compounds, can modulate mitochondrial homeostasis in a reserpine-induced rat model of FM. Rats received daily oral SP (400 mg/kg), and behavioral and molecular parameters were assessed. SP treatment alleviated FM-like symptoms, including hyperalgesia, locomotor deficits, and weight loss. At the molecular level, SP activated a PGC-1α-related mitochondrial biogenesis pathway in the spinal cord, as indicated by increased nuclear PGC-1α and upregulation of NRF-1, TFAM, and UCP2. SP also improved mitochondrial antioxidant defenses (SOD2, catalase, PRDX3) and reduced oxidative stress, as shown by reduced ROS production and lipid peroxidation. Immunofluorescence analyses further indicated a cell-specific modulation of apoptotic signaling, with reduced Bax/Bak expression in both neurons and astrocytes. In addition, SP modulated mitochondrial dynamics by increasing Mfn2/Opa1 and reducing Drp1/Fis1.

To further investigate the underlying mechanisms, in vitro experiments were performed in rotenone- treated SH-SY5Y cells, showing that SP restored ATP levels, reduced mitochondrial ROS, and improved mitochondrial morphology. Notably, pharmacological inhibition of PGC-1α attenuated these protective effects, supporting the involvement of this pathway.

Overall, SP may exert neuroprotective effects by supporting mitochondrial function and redox balance through mechanisms involving PGC-1α signaling, mitochondrial biogenesis, and regulation of mitochondrial dynamics. These findings highlight mitochondrial pathways as potential therapeutic targets in FM, although further studies are required to confirm causality and translational relevance.

O11 Oral Presentation

Pistachio Leaf Extract Promotes Redox-Dependent Mitochondrial Adaptation and Metabolic Responses in Ethanol-Stressed HepG2 Cells

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Abstract

Ethanol-induced hepatocellular injury is characterized by redox imbalance and mitochondrial dysfunction, which critically determine cellular adaptation to metabolic stress. Rather than acting as simple antioxidants, effective nutraceutical strategies may enhance endogenous adaptive responses that preserve cellular homeostasis. Pistachio (Pistacia vera L.) leaves, an underexplored agricultural by-product, represent a potential source of bioactive compounds with redox-modulating properties. In this study, we investigated the effects of pistachio leaf extract (PLE) in human HepG2 hepatocytes exposed to 1% ethanol (EtOH). EtOH reduced cell viability and increased intracellular and mitochondrial reactive oxygen species (ROS), while triggering compensatory responses including glutathione accumulation and activation of metabolic and inflammatory pathways. PLE alone induced a mild cytosolic ROS signal and increased PGC-1α expression, consistent with hormetic activation of mitochondrial regulatory mechanisms.

Notably, co-treatment with EtOH and PLE significantly reduced both cytosolic and mitochondrial ROS levels, prevented excessive glutathione accumulation, and improved glutathione turnover. These effects were associated with coordinated modulation of genes involved in mitochondrial biogenesis and metabolic adaptation, including PGC-1α, TFAM, SIRT1, PPARα, and UCP2. In parallel, PLE attenuated EtOH-induced IL-6 expression without preventing FAS upregulation, indicating a selective dissociation between inflammatory and lipogenic responses.

Overall, our findings demonstrate that PLE acts as a modulator of redox-dependent signaling rather than a direct antioxidant, promoting mitochondrial adaptability and modulating cellular responses to ethanol-induced stress. These results support the potential of pistachio leaf-derived phytocomplexes as nutraceutical modulators of hepatocellular adaptive responses.

O12 Oral Presentation

Icariin and Baicalin improve post exercise recovery by enhancing bioenergetic efficiency and adaptive stress response in zebrafish larvae

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Nutritional modulation of metabolic stress responses is central to biochemical nutrition, especially in muscle performance and post-exercise recovery. Exercise imposes a high energetic and redox burden: although required for adaptation, excessive stress may impair recovery and promote protein catabolism. Bioactive compounds with antioxidant and metabolic properties may improve recovery efficiency. Icariin and baicalin have been linked to metabolic activation and antioxidant modulation, but their combined effects remain unclear. Here, we investigated their pre-treatment on locomotor recovery and metabolic adaptation in Danio rerio larvae subjected to sustained swimming against water current. Exercise induced a profile marked by increased AMP levels, nitrosative stress, and activation of nitrogen metabolism. Icariin promoted an “exercise-mimetic” phenotype, improving locomotor performance while maintaining elevated AMP, consistent with increased metabolic demand. Baicalin attenuated energy turnover and partially limited locomotor output, suggesting a protective but less performance-oriented profile. Combined treatment improved swimming velocity and distance during recovery. This was associated with increased ATP and a higher ATP/AMP ratio, indicating enhanced bioenergetic efficiency. This phenotype occurred with low AMP, suggesting decoupling between functional output and energetic stress. The combined treatment increased nitrosative stress markers and uric acid, supporting activation of an adaptive purine-based antioxidant response rather than simple reduction of oxidative stress. Urea changes further indicated modulation of nitrogen metabolism. Overall, combined icariin and baicalin pre-treatment enhances post-exercise recovery by optimizing cellular bioenergetics and adaptive resilience to nitrosative stress. This response improves locomotor performance while reducing metabolic burden, highlighting a potential synergistic role in improving muscle efficiency and recovery.

O13 Oral Presentation

THE HIDDEN SIDE OF SPORT PERFORMANCE: THE SCREENING OF THE FEMALE ATHLETE TRIAD

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The Female Athlete Triad is a clinical condition characterized by low energy availability (LEA), menstrual dysfunction, and reduced bone mineral density. This condition has significant implications for health and athletic performance [1]. This study aimed to evaluate the risk of LEA in a group of young female athletes by using a combination of validated screening tools (LEAF-Q and DESA-6) and analysing their dietary habits via the Food Frequency Questionnaire (FFQ) and 24-hour recall [2]. A cross-sectional observational study was conducted with 34 female athletes (mean age 17.1 ± 3.3 years) predominantly practising gymnastic. The results showed that, according to the LEAF-Q, 41% of participants were at risk of LEA. Furthermore, frequent menstrual irregularities (32.4%) and a high incidence of injury (76.5%) were observed, findings which are consistent with the manifestations of the triad. Analysis using the DESA-6 revealed widespread body dissatisfaction and significant concern about weight gain. Dietary assessment showed generally insufficient caloric intake, low carbohydrate consumption, and limited dietary variety. These habits result inadequate to support the energy requirements of athletic activity. The results underline the importance of early screening and nutritional education among female athletes to prevent LEA and its consequences, and the need for a multidisciplinary approach to managing the triad involving qualified healthcare professionals.

O14 Oral Presentation

From diet to endocrine function: cyanidin-3-O-glucoside modulates PKA signalling, metabolism, and androgen synthesis in Leydig cells

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Oxidative balance is a key determinant of male reproductive health, as physiological levels of reactive oxygen species (ROS) are essential for intracellular signaling, whereas their dysregulation is linked to infertility. Among dietary bioactives, cyanidin-3-O-glucoside (C3G), a major anthocyanin widely present in Mediterranean foods, has attracted increasing attention for its nutraceutical properties. Given the central role of the AC–cAMP–PKA signaling axis in steroidogenesis, this study investigated the effects of C3G on Leydig cell metabolism and androgen biosynthesis under physiological conditions. Murine TM3 Leydig cells were exposed to nutritionally relevant concentrations of C3G (0.50, 5.00, 50.00 µM). Cellular responses were assessed through cytotoxicity assays, redox profiling (ROS, 4-HNE, protein nitration and carbonylation), and mitochondrial function (JC-1 staining, mtDNA content, Sirt1 expression). Steroidogenic activity was evaluated by androstenedione quantification, gene expression analysis, and PKA substrate phosphorylation, alongside ^{1}H-NMR-based exometabolomics. Metabolomic data revealed a C3G-induced metabolic shift toward glycolysis and glutaminolysis, characterized by increased glucose consumption and lactate release. Concurrently, C3G reduced oxidative stress and preserved mitochondrial membrane potential. Despite these beneficial effects, androstenedione production was significantly decreased, without alterations in Star mRNA levels. The observed reduction in global PKA substrate phosphorylation suggests a selective inhibition of PKA type II activity, potentially uncoupling gene expression from functional steroidogenesis. These findings highlight that dietary polyphenols may exert complex and context-dependent effects, not always simplistically attributable to antioxidant activity that may be contextualized in the consumption of polyphenol-rich foods and antioxidant supplementation modulating the intrinsic metabolic pathways.

O15 Oral Presentation

Luminescent Bioanalytical Platforms for Exploring New Biomarkers in Nutrition And Human Health Within Complex Biological Matrices.

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Investigating how diet, metabolism, and environmental exposures influence human health remains challenging in complex biological matrices, where functional readouts are often limited. Luminescence provides highly sensitive, versatile and cost-effective analytical solutions. Here, we present bioassays targeting distinct, yet interconnected biomarkers associated with human health.

An all-in-one chemiluminescent turn-on bioassay was developed for quantitative intracellular H_2O_2 detection in freshly isolated peripheral blood mononuclear cells (PBMCs) as an effect-based measure of oxidative stress. Applied to PBMCs from hypercholesterolemic subjects, the assay revealed reduced H_2O_2 production after pharmacological treatment, significantly associated with improved vascular stiffness, supporting its value as a functional tool for ex vivo monitoring of oxidative status and cardiovascular health.

A whole-cell bioluminescent (BL) bioassay based on an amino-luciferin chenodeoxycholic acid conjugate (aLuc-CDCA) was developed to quantify bile salt hydrolase (BSH) activity in human stool samples. Application to fecal matrices from healthy subjects and patients with

adenomas or colorectal cancer revealed increased BSH activity associated with altered bile acid homeostasis and disease progression, supporting the assay as a rapid and cost-effective approach for microbiota assessment in complex fecal matrices.

Finally, a yeast-based BL biosensor exploiting the caffeic acid cycle was developed for urinary phenolic metabolites detection. The assay enabled rapid and reliable analysis in human urine, providing a non-invasive approach to assess polyphenol exposure and metabolic changes. Healthy volunteers were successfully profiled following dietary intervention, supporting its use as a simple and scalable tool for personalized nutrition monitoring.

Overall, luminescent bioassays emerge as advanced bioanalytical tools for biomarker assessment and personalized health applications.

O16 Oral Presentation

Exploring the Nutrigenomic Potential of Broccolo nero: Multi-Omics Insights into Epigenetic Modulation and Anti-Inflammatory Signalling

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Within the Brassicaceae family, Broccolo nero (BN) stands out for its unique profile of glucosinolates and polyphenols, which are widely studied for their chemopreventive and antioxidant properties [1]. However, despite their documented anti-inflammatory potential, the precise molecular pathways through which these compounds modulate gene expression and cellular signalling remain to be fully elucidated. In this study, we investigated BN 'novel foods' (sprouts, microgreens, and baby leaves) to determine the correlation between the plant's developmental stage and its specific cytotoxic activity and modulation of the inflammatory response. Supported by the ELIXIRxNextGenIt-1st NOA Call, we applied an integrated multi-omics strategy combining transcriptomic profiling, DNA methylation analysis, and omega-3 fatty acid (including LA, EPA, and DHA) quantification to evaluate BN leaf extracts in tumorigenic (SKBR-3) model. This study aims to determine whether the phytochemical 'fingerprint' of Broccolo nero evolves significantly during plant maturation, triggering distinct, stage-dependent molecular signatures. Our findings are expected to demonstrate how this transition dictates the differential activation of redox-sensitive pathways and the epigenetic modulation of inflammatory mediators. By elucidating how these developmental shifts program cellular responses, this work strives to advance our understanding of BN as a dynamic source of bioactive signals. These insights are crucial for defining optimal harvest timing to maximize therapeutic efficacy and for developing targeted nutraceutical strategies within the framework of personalized nutrition.

O17 Oral Presentation

Targeting the Metabolic-Epigenetic Axis in Breast Cancer: The Role of DJ-1 and Histone Glycation

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Recently, a plethora of histone non-enzymatic covalent modifications, correlating the epigenome landscape and metabolic rewiring, has been described. From a nutritional and metabolic perspective, conditions such as chronic hyperglycemia, obesity and systemic oxidative stress are known to elevate reactive dicarbonyls cellular levels, particularly methylglyoxal. These states promote carbonyl stress, leading to the accumulation of Advanced Glycation End-products (AGEs) that can act as glycating agents reacting with cellular macromolecules. In breast cancer cells, high glycolytic flux induces intense carbonyl stress, promoting histone glycation and ultimately disrupting the histone code and chromatin architecture. DJ-1, a deglycase frequently dysregulated in tumors, plays a key role in maintaining cancer cell proliferation by limiting AGEs formation. Through omics analyses, we identified a novel DJ-1 phosphorylated proteoform that seems to prevent histone glycation by sustaining DJ-1 glyoxalase activity within the nucleus. Using this proteoform as a docking template, we performed virtual screening on FDA-approved compounds and identified HIT3 as a promising selective inhibitor. Across multiple breast cancer models, HIT3 significantly inhibited phospho-DJ-1, resulting in a reduction of histone glycation. Notably, the triple-negative BRCA1-mutated HCC1937 cell line showed heightened sensitivity. In our model, histone glycation accumulation, combined with the absence of a functional BRCT domain, induces a form of synthetic lethality. These findings suggest that the metabolic-epigenetic vulnerability of cancer cells can be exploited therapeutically, highlighting the critical link between glycation precursors and genomic stability. Further investigation is warranted to elucidate the molecular interplay between BRCA1 function and glycation-driven chromatin remodeling.

O18 Oral Presentation

Valorization of Whey through a Fermented Functional Food Enriched with Milk-Derived Bioactive Peptides for the Prevention of Intestinal Inflammatory Disorders

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The increasing production of whey as a major dairy by-product poses significant environmental and economic challenges, while also offering an untapped source of proteins and protein-derived bioactive compounds. In this work, a sustainable protein-centered strategy to valorize whey through the development of a fermented functional food enriched with milk-derived bioactive peptides for the prevention of intestinal inflammatory disorders was described.

A fermentation protocol based on Lactiplantibacillus plantarum was established to improve whey stability and technological functionality. Fermented whey was then enriched with the bioactive peptides I14K and G14K, previously isolated from proteins in milk of mastitis-affected cows using Surface Active Maghemite Nanoparticles. Structural profiling by HPLC and LC-MS/MS identified distinctive peptide features associated with antioxidant and anti-inflammatory potential, highlighting the value of disease-associated milk proteins as unconventional sources of functional sequences.

The food prototype was first evaluated in vitro during storage at 4°C to assess antioxidant stability over time. Its biological efficacy was then investigated in a murine model of DSS-induced colitis. Mice received the whey-based formulation enriched with peptide I14K by oral administration for 15 days, with colitis induced during the last 3 days. Immunological and molecular responses were assessed by flow cytometry, RT-PCR, ELISA, and Western blot to characterize inflammatory pathways and oxidative stress modulation in the gut. Notably, preliminary results suggest that the formulation may provide promising protection against the inflammatory state and oxidative stress associated with DSS-induced colitis in mice.

Overall, this work emphasizes the potential of dairy proteins as reservoirs of health-promoting peptides and supports the design of sustainable functional foods linking protein science, gut health, and circular bioeconomy.

O19 Oral Presentation

VALORIZATION OF COFFEE SILVERSKIN: FROM BYPRODUCT TO FUNCTIONAL INGREDIENT

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Background: The valorization of agro-industrial byproducts is important for sustainability and the circular economy. Roasted coffee silverskin (CSS), recognized in the European Union as a novel food, is a source of bioactive compounds, although its use in the food industry is still limited.

Objective: The aim of this study was to characterize the chemical and nutritional profile of silverskin, as well as its potential use as a functional ingredient in enriched bread, with a particular focus on its antioxidant properties and effect on postprandial glycemia.

Methods: Samples of coffee silverskin (CS) from different coffee varieties were analyzed to determine macronutrient composition, dietary fiber, total polyphenols, flavonoids, and antioxidant capacity. In a second phase, CS was incorporated into bread formulations at 4% and 6%, while conventional bread was used as control. The functional properties of the enriched breads were assessed by evaluating nutritional composition, bioactive compounds, in vitro glycemic index, and sensory acceptability.

Results: CS, especially from Coffea arabica Brasile Santos, showed high fiber and polyphenol content with strong antioxidant activity. Its addition to bread significantly increased these compounds in a dose-dependent manner, compared to control bread. CS-enriched breads also reduced starch digestion and glucose release in vitro, suggesting a lower glycemic response. Sensory analysis showed good acceptability, particularly for the 4% CS bread.

Conclusions: Coffee silverskin is a promising functional ingredient that improves bread nutritional quality and may help modulate glycemic response, supporting cardiometabolic prevention and sustainable reuse of agri-food by-products. However, its use in the European Union still requires novel food authorization.

O20 Oral Presentation

Food matrix modulates antioxidant bioaccessibility and intestinal barrier protection: enhanced effects in pigmented wheat pasta compared to bread

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Food structure plays a key role in modulating nutrient bioaccessibility and the biological activity of cereal-based foods. However, the interplay between raw material composition and processing in shaping the functional properties of pigmented wheat products remains poorly understood.

This study investigated the impact of semolina type [pigmented wheat (Grano Mischio, GM) vs. conventional wheat (Senatore Cappelli, SC)] and food matrix (bread vs. pasta) on technological properties, in vitro starch digestibility, antioxidant activity, and intestinal epithelial response. Following simulated gastrointestinal digestion, antioxidant capacity was assessed (ORAC, DPPH, ABTS), and biological effects were evaluated in Caco-2 cells by measuring viability, transepithelial electrical resistance (TEER), and inflammatory markers (RT-PCR).

The food matrix significantly influenced both physicochemical and functional outcomes. GM bread showed reduced volume and increased hardness compared to SC bread, while GM pasta exhibited higher starch digestibility than SC pasta. Antioxidant activity was matrix- and assay-dependent: GM bread showed the highest ORAC values, whereas GM pasta exhibited the strongest radical scavenging capacity in DPPH and ABTS assays. Notably, digested GM pasta significantly improved Caco-2 cell viability and enhanced epithelial barrier integrity, as demonstrated by increased TEER. Under inflammatory conditions, GM pasta also reduced NF-κB expression and promoted epithelial recovery more effectively than the other samples.

These findings highlight that, beyond raw material composition, food structure is a critical determinant of bioactive compound delivery and biological efficacy. In particular, the dense pasta matrix appears to enhance the retention and functional impact of polyphenols from pigmented wheat. This study supports the importance of considering matrix architecture in the design of cereal-based functional foods targeting gut health.

O21 Oral Presentation

Antioxidant and Phenolic Content of Sardinian Fabaceae Cultivars: Influence of Extraction Methods and Species Variability

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Legumes are worldwide recognized for their health-promoting potential as they are naturally rich in phytochemicals [1-2]. Avoiding ROS accumulation, these compounds prevent chronic diseases such as type 2 diabetes and cardiovascular conditions [3]. In this context and in the perspective of valorizing local biodiversity, our research investigates the nutraceutical properties of eleven Sardinian cultivars from Fabaceae family, selected for their commercial relevance. Grass pea, fava beans, lentils, chickpeas, peas, and common beans were included, with Lamon bean used as a control [2]. Methanolic and aqueous extracts were obtained and antioxidant capacity was analysed through FRAP and ABTS assays, while total phenolic content (TPC) was determined using Folin–Ciocalteu method.

Consistent reducing power was observed across cultivars, with peas showing highest values (1.38±0.12 to 2.52±0.19), followed by fava beans (0.86±0.05 to 1.13±0.12), lentils (0.63±0.040 to 0.73± 0.040), grass peas (0.33±0.017 to 0.60±0.035), chickpeas (0.29±0.012 to 0.50±0.032), and common beans (0.29±0.007 to 0.95±0.096). Overall, higher values were observed in methanolic extracts compared to aqueous ones, except for pea cultivar. Scavenging activity showed an opposite trend, ranging as follows: peas (0.13±0.021 to 0.39±0.034), fava beans (0.27±0.017 to 0.39±0.034), chickpeas (0.078±0.016 to 0.24±0.024), lentils (0.090±0.017 to 0.21±0.022), common beans (0.10±0.033 to 0.24±0.025), and grass peas (0.061±0.010 to 0.22±0.020). A comparable trend was observed for TPC, with generally lower values in methanolic extracts.

These findings validate the antioxidative effect of pulses, highlighting marked variation depending on extraction methods and legume species. Further activities to be investigated are antidiabetic ones via α-amylase and α-glucosidase inhibition, including in vivo models. Besides, isolation and characterization of the bioactive compounds in functional foods could clarify their mechanism of action and related capacities.

O22 Oral Presentation

Polyphenolic Extract from Thinned Apples Accelerates Cutaneous Wound Healing by Targeting Oxidative Stress Pathways, Angiogenic Responses, and Fibrotic Processes in Diabetic versus Non-Diabetic States

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Wound healing (WH) is an important physiological process that maintains the integrity of skin after trauma. In diabetic patients, skin's healing is retarded because all stages of WH are altered, including angiogenesis and reepithelialization. Thus, new therapeutic alternatives aimed to restore of skin integrity are required. Apples, thanks to the polyphenol fraction, exert a protective action in some human diseases including diabetes. Thinned young apples (a massive waste product of apple cultivation) are particularly rich in polyphenols, more than 10-fold with respect to harvested apples. Therefore, the objective of this study was to evaluate the beneficial proprieties of thinned apple polyphenols (TAP) extract in a model of WH in diabetic e non-diabetic mice. Two full-thickness excisional wounds were generated on the dorsum of mice and TAP extract (10 mg/kg, o.s.) was administered for 7 days in non-diabetic and diabetic mice. Our results demonstrated that TAP extract was able to accelerate skin WH, induce the maturation of new collagen (Masson trichrome staining), downregulating metalloproteinases in both groups treated. Additionally, TAP extract administrations ameliorated dysfunction of endothelial and angiogenic process (eNOS and VEGF) and induced Nrf2 activation and the up-regulation of HO-1 and SOD. These results suggest that TAP extract was able to accelerate wound closure equally in non-diabetic and diabetic mice, despite a worse base-line condition induced by hyperglycemia.

O23 Oral Presentation

CIRCULATING AND PLASMA SIGNALING LIPID PROFILING IN MATERNAL OBESITY AND GESTATIONAL DIABETES

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Introduction:

The endocannabinoid (EC) system plays a fundamental role in regulating human pregnancy, controlling processes associated with the early stages of labor and birth. This system functions in close coordination with eicosanoid (ES) signaling pathways to maintain optimal gestational regulation [1]. Metabolic conditions such as maternal pre-pregnancy obesity (OB) and gestational diabetes mellitus (GDM) are known to impair the normal function of the placenta and increase the risk of adverse clinical complications [2]. However, several detrimental mechanisms occurring in the placentas of OB women still need to be clarified. Previous research has identified plasma or placental specific endocannabinoids, principally arachidonoyl ethanolamide (AEA) and 2-Arachidonoyl glycerol (2-AG) tone variation in OB but further investigations into lipid mediators and their roles in pathological pregnancies remain incomplete. This research aims to characterize the circulating and placental signaling lipid profiles associated with OB and GDM to identify potential new early biomarkers for placental dysfunction or pregnancy complications.

Material and methods:

43 Caucasian women undergoing to cesarean section were enrolled: 27 with obstetric condition with body mass index (BMI) ≥30, 8 of which were affected by gestational diabetes mellitus (OB-GBM), and 16 of their came from normal BMI (18.5-25) mothers. A targeted HPLC-MS/MS analysis was performed to quantify 20EC-12ES-3PUFA on placental and plasma samples (25mg-placenta homogenate 10% water (PLAC) and/or 250ul-plasma (PL)) [2].

Result and conclusion:

16(PLAC),18(PL) lipids were quantified in all samples, with statistically significant differences for 6 lipids in PLAC; interestingly, prostaglandinF2alfa, involved in labor induction, was undetectable in NW, quantifiable in a few OB, and in all OB-GDM, PL samples suggesting it as a potential marker for early labor. linked to DGM condition. Marked alterations in placental lipid profiles, with significant dysregulation of the EC and ES was also reviled. The placenta exhibited an approximately 5fold higher ω-6/ω-3 ratio compared with plasma. While pathological pregnancies were associated with reduced plasma PUFA and EC, placental tissue showed decreased ES and increased EC, suggesting a compartment-specific disruption of lipid signaling in maternal OB and GDM.

Spearman's rank correlation analysis (ρ) was performed to investigate association between placental and/or plasma lipid mediators and clinical data. In the whole population, there was a positive intercorrelations between 2-AG plasma levels with other circulating inflammatory mediators like Leukotriene B4 (LTB4), Prostaglandin E2 (PGE2), Prostaglandin D2 (PGD2), and 5-Hydroxyeicosatetraenoic acid (5-HETE) (all $p < 0.001$). Considering correlations of circulating lipids and clinical data a negative correlation between fetal weight and plasma 2-AG ($r = -0.391$, $p = 0.024$), and maternal placental weight and several plasma inflammatory lipid mediators, (AEA, 2-AG, LTB4,

PGE2, PGD2, and 5-HETE (all $p<0.05$)) were shown. Taken together those results suggest a link between the modulation of the ECS activity and placental homeostasis and function. Additionally, OGTT-I was positively associated with several plasma EC and EC-like mediators, including AEA and N-acyl ethanolamides of linolenic, linoleic, palmitic, oleic and stearic acids (all $p < 0.05$), indicating a link between early glucose response and lipid signaling pathways. Finally, placental AEA and linolenoylethanolamide (LNEA) were positively correlated with plasma 5-HETE in the OB+GDM group but inversely correlated in NW individuals, indicating a shift from a regulated to a dysregulated endocannabinoid–lipoxygenase metabolites interaction in obesity. Our preliminary results, despite being based on a small population, suggest interesting differences in the lipid profile associated with OB and OB-GDM, for the first time, paving the way for future research in this area.

O24 Oral Presentation

Diabetes-induced metabolic stress drives corneal neuropathy: protective effects of a multicomponent ophthalmic formulation in a chick embryo model.

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Diabetes-related metabolic stress disrupts corneal homeostasis and promotes corneal neuropathy, an underrecognized ocular complication of diabetes [1]. Hyperglycemia-driven oxidative stress, inflammatory activation, and impaired neurotrophic support contribute to nerve damage, epithelial alterations, and defective corneal repair [2]. In this context, bioactive ophthalmic formulations may help to preserve the ocular surface [3]. We investigated the effects of a hyaluronic acid-based ophthalmic formulation (POF) enriched with vitamins and plant-derived bioactive components, including Pycnogenol, a maritime pine bark extract, in a streptozotocin-induced diabetic chick embryo model. Diabetic corneas showed epithelial thickening, stromal disorganization, and inflammatory cell infiltration, confirming a reproducible damage phenotype associated with metabolic stress. Notably, POF restored corneal epithelial architecture and significantly reduced systemic oxidative stress, as indicated by lower reactive oxygen metabolites and trimethylamine N-oxide levels. At the molecular level, POF attenuated the diabetes-associated upregulation of IL-1β, MMP-9, and VEGF-A, restored VEGF-B and NGF expression toward control levels, and increased BDNF and Substance P expression, consistent with improved neurotrophic support. Overall, POF exerted protective effects against diabetes-induced corneal neuropathy by modulating redox, inflammatory, angiogenic, and neurotrophic pathways.

O25 Oral Presentation

Dietary phytochemical Indicaxanthin modulates NF-κB signaling in IL-1β-activated human synovial fibroblasts: integration of biochemical and biased molecular dynamics approaches

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Abstract

Rheumatoid arthritis (RA) is a chronic autoimmune disease driven by persistent synovial inflammation, in which synovial fibroblasts (SFs) play a key role through activation of NF-κB signaling. In this study, we investigated the anti-inflammatory potential of indicaxanthin (IND), a bioavailable dietary betalain derived from Opuntia ficus-indica fruit, focusing on its ability to modulate IL-1β-induced responses in human SW982 synovial fibroblasts. IND significantly attenuated IL-1β-induced oxidative stress by reducing intracellular reactive oxygen species (ROS) and nitric oxide (NO) levels, while preserving glutathione (GSH) content. These effects were accompanied by a marked downregulation of redox-sensitive enzymes, including iNOS and COX-2. Furthermore, IND reduced the secretion of pro-inflammatory cytokines (IL-6, IL-8, TNF-α) and matrix metalloproteinase-3 (MMP-3), while enhancing the release of the anti-inflammatory cytokine IL-10. Mechanistically, IND inhibited the IL-1R1/MyD88/NF-κB signaling axis, decreasing the expression of key Myddosome components (IL-1R1, MyD88, IRAK1, IRAK4) and suppressing phosphorylation of IκBα and NF-κB p65. Computation analyses, including induced-fit docking and binding pose metadynamics, revealed that IND can interact with IL-1β at multiple sites, with preferential and stable binding within an allosteric pocket, suggesting a potential mechanism of action involving modulation of cytokine conformational dynamics. Overall, these findings demonstrate that IND modulates IL-1β-driven inflammatory and oxidative responses in synovial fibroblasts at concentrations compatible with dietary intake, supporting its potential role as a dietary bioactive compound in the complementary management of RA.

O26 Oral Presentation

Methylene blue removal from aqueous solutions by alginate@chitosan beads containing microbial melanin

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Methylene blue (MB) is a toxic cationic dye, used in textile industry, that is frequently discarded in wastewater without any treatments. Melanin pigments have remarkable properties, such as UV-visible light absorption and xenobiotic chelation ability so that might be used in environmental bio-remediation processes [1]. In this work microbial melanin, biotechnologically produced and purified by S. nashvillensis DSM 40314, was inserted in composite, biodegradable alginate and chitosan beads (Al-Mel@CH beads) for the removal of MB from aqueous solutions. Initial characterization of the material by SEM showed a highly porous and irregular surface morphology while ATR-FTIR analyses confirmed the successful incorporation of melanin within the alginate network. Starting from a 5.0 ppm dye concentration, the beads showed a MB removal efficiency up to 73.0% in about 40 minutes in both MilliQ water and simulated textile waste water. Kinetic modeling studies suggested that the process followed a pseudo-second-order mechanism, implying a chemisorption process. Once entrapped in the beads, the MB was not released in the surrounding environment, thus a strategy to convert it into the less toxic leuco-methylene blue form, by photo-degradation, was set up, taking advantage of the fact that melanin, contained in the beads, enhanced the possibility to produce radical species, in presence of hydrogen peroxide, after exposition to both UV and visible light.

O27 Oral Presentation

Oxidative and metabolic profile of human red blood cells in the presence of bisphenol B

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Bisphenols (BPs) are chemicals that are widely used as monomers in the production of plastics to improve their flexibility and strength. However, errors in polymerization processes or degradation phenomena can trigger the migration of BPs from packaging to food and beverages. Exposure to these compounds poses a critical risk to human health, as BPs are classified as endocrine disruptors and potent oxidizing agents. Although the literature extensively describes the action of BPs on different cell lines, their impact on red blood cells (RBCs) remains poorly studied. The present study evaluates the action of bisphenol B (BPB) on RBCs by analyzing their impact on the membrane (hemolysis and morphology), on the oxidative state (methemoglobin, lipid peroxidation, thiol groups, superoxide dismutase and catalase activity), on the metabolic framework (anion flux kinetics, phosphatase activity, ATP levels) and on caspase 3 activity. Our results show that after 2 hours of incubation BPB (from 5.0 to 50.0 nM) causes a slight increase in hemolysis percentage at the highest concentrations, while after 24 hours all the concentrations induce a significant increase in membrane damage and slight changes in cell morphology. After 2 hours of incubation, low concentrations of BPB (5.0 nM) cause oxidation of thiol groups, lipid peroxidation, increased catalytic activity of superoxide dismutase and catalase, and activation of caspase 3, indicating a decisive trend towards the worsening of the cellular oxidative picture. This adverse condition may be counteracted by the increase in kinetics of the anion flow through the band 3 protein, which partially could explain the resistance to hemolysis recorded after few hours of incubation with BPB. Even if this fails to counteract the cell death triggered by the caspase activation and which for longer incubation times, inexorably leads the cell to lysis.

O28 Oral Presentation

Exploring the anti-inflammaging potential of a callus extract from a heritage Italian apple variety: a multiomic approach

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Mela Rosa Marchigiana (MRM), an apple variety from central Italy, can be used to produce in vitro callus cultures rich in pentacyclic triterpenic acids with putative anti-inflammatory properties. In this study, human umbilical vein endothelial cells (HUVECs) were used as a model of replicative senescence to investigate the effects of an ethanolic extract from MRM callus (MRME) using a multiomic approach, combining transcriptomic profiling and genome-wide Nanopore-based DNA methylation analysis.

Senescent HUVECs were treated with MRME in short-term experiments (1 μg/mL for 72 h) and compared to untreated senescent cells. Transcriptomic analysis revealed that MRME downregulated TNF-α signaling genes, partially restoring expression toward levels observed in young HUVECs. Genome-wide DNA methylation analysis did not reveal significant changes, suggesting that MRME acts primarily through transcriptional modulation rather than DNA methylation remodelling.

To fully capture the extract's potential, a long-term treatment was applied during replicative senescence on HUVEC cells to elucidate sustained modulation of the transcriptome by MRME. HUVECs were treated daily with MRME (2h/day) from passages 3 to 17, transcriptomic analysis was performed to compare senescent untreated cells with cells treated with MRME during replicative senescence; data analysis is currently ongoing. Overall, these results highlight MRME as a promising candidate for the development of functional foods or nutraceuticals, exerting anti-inflammatory and anti-aging effects likely mediated by modulation of inflammaging genes.

Poster Presentations

P01 Poster Presentation

Natural antioxidant effect on tissue transglutaminase levels in glial olfactory cells exposed to amyloid-β: Integrated Biochemical and Computational study

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Abstract

Several findings report the protective effect exerted by nutraceuticals on the health of the nervous system, since many compounds are characterized by antioxidant and anti-inflammatory activities. Alzheimer Disease (AD) is characterized by an aberrant accumulation of amyloid-β (Aβ) responsible of neurotoxicity. Our research focuses on the interaction between some natural antioxidants (berberine and curcumin) and tissue transglutaminase (TG2) levels, in the absence and in the presence of amyloid-β (Aβ) in Olfactory Ensheathing Cells (OECs), a glial cell type of olfactory system. TG2 is an ubiquitarian calcium-dependent protein, involved in AD. Docking studies were performed to ascertain the binding affinity of compounds against the TG2 closed and open forms. In the biological investigation, the effect of berberine and curcumin treatment on TG2 levels in OECs exposed to Aβ was tested. Cell viability, cytoskeleton marker (GFAP, vimentin and nestin) expression, reactive oxygen species (ROS) and apoptotic pathway activation were assessed. Our results demonstrate that pretreatment of OECs with berberine or curcumin counteracted the Aβ-induced upregulation of TG2, restoring its expression to control levels. Furthermore, antioxidant pretreatment reinstated cell viability, normalized the expression of GFAP, vimentin, and nestin, reduced intracellular ROS accumulation, and prevented activation of the apoptotic cascade. The computational data were in quite agreement with biological results. Our findings highlight that berberine and curcumin are able to exert a protective effect against Aβ toxicity in OECs. Therefore, they might represent a promising tool for neural regeneration and for potential therapy slowing or preventing the progression of AD.

P02 Poster Presentation

Dose- and Time-Dependent Effects of Perfluorobutane Sulfonic Acid on Microglial Cells

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Per- and polyfluoroalkyl substances (PFAS) are synthetic compounds widely used in industrial and consumer applications because of their surfactant properties and environmental persistence. Human exposure to PFAS is widespread and has been associated with several adverse health effects. As long-chain PFAS are progressively phased out, short-chain alternatives such as perfluorobutane sulfonic acid (PFBS) are increasingly used due to their lower bioaccumulation potential. Growing evidence suggests that PFBS may still pose risks to human health [1], while its neurotoxic effects remain poorly understood.

To this aim, we employed the BV-2 microglial cell line to investigate the potential neuroinflammatory effects of PFBS. Cells were treated with increasing concentrations of PFBS for 24 and 48 h, and cell viability was assessed by MTT assay. Exposure to PFBS induced a time- and concentration-dependent effect on cell viability. After 24 h treatment, PFBS promoted a progressive increase in cell viability up to 500 µM, suggesting a possible stimulatory or adaptive cellular response at lower concentrations. However, higher concentrations reduced viability, with a significant decrease at 1.5 mM. After 48 h of exposure, cell viability remained substantially unchanged up to 50 µM, whereas higher concentrations induced a marked dose-dependent decline. The PFBS selected for exposure tests was characterized using 19F and 13C NMR Spectroscopy. A 19F sequence was implemented for the quantification, which will be used to determine the exact concentrations of PFAS in cell exposure studies. These findings suggest biphasic effects of PFBS on BV-2 cells. Further investigations are currently underway to elucidate the molecular mechanisms underlying PFBS-induced neuroinflammatory and metabolic alterations.

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P03 Poster Presentation

Effects of burned and heated cigarette smoke extracts on oxidative stress and extracellular vesicle biochemical cargo in bronchial epithelial cells

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Cigarette smoke (CS) is one of the major environmental risk factors for several chronic diseases, mainly through mechanisms involving oxidative stress. In recent years, heated tobacco products (HTPs) have been proposed as alternatives to conventional cigarettes (CC), although their biological effects are not yet fully understood. Here, we reported findings from a comparative evaluation of the effects of burned CS extract (bCSE) and heated CS extract (hCSE) on human bronchial epithelial BEAS-2B cells and their released extracellular vesicles (EVs).

Both CSs reduced cell viability in a dose-dependent manner and increased intracellular reactive oxygen species levels, as well as the levels of carbonylated proteins and the expression of antioxidant enzymes (i.e. catalase, SOD2 and HO-1). Notably, higher concentrations of hCSE are needed to elicit effects comparable to those of bCSE. Furthermore, both hCSE and bCSE altered the molecular cargo of released EVs, which exhibited higher levels of carbonylated proteins and alteration in phospholipid composition. The removal of oxidized proteins via EVs may represent a cellular defence mechanism employed by CSE-treated cells to mitigate, at least in part, the intracellular accumulation of damaged proteins. Regarding lipid composition, EVs derived from bCSE-treated cells showed increased levels of lipid species containing saturated fatty acids, whereas EVs from hCSE-treated cells were enriched in lipid species containing polyunsaturated fatty acids. The distinct lipid composition of EVs released from bCSE-treated cells and those from hCSE-treated cells might become a potential biomarker to distinguish cellular responses to different types of CS exposure.

Overall, these findings indicate that both bCSE and hCSE induce oxidative stress, increase antioxidant responses, and promote significant changes in EV content, although hCSE exerts toxic effects at higher concentrations. EVs may become potential circulating biomarkers for the early detection of smoke-induced lung damage. In addition, investigating their biochemical and biological properties may provide deeper insight into the pathogenic mechanisms triggered by different types of smoke exposure.

P04 Poster Presentation

Upcycled Potato Peel Bioactives Modulate Stress Responses and Enhance Recovery in Human Keratinocytes

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The valorization of agri-food waste as a source of high-value bioactive compounds represents a strategic axis of the circular economy, enabling the conversion of low-cost organic residues into functional ingredients for health-related and dermocosmetic applications. Among these residues, potato peel—one of the major byproducts of the potato processing chain—constitutes a rich reservoir of phytochemicals, including glycoalkaloids and phenolic acids with documented antioxidant and membrane-modulating properties. This study investigates the protective effects of extracts obtained from two organic Solanum tuberosum L. cultivars widely used in industrial processing, Lady Claire (LC) and Lady Rosetta (LR), focusing on cytocompatibility, redox-modulating activity, and their ability to counteract oxidative stress and early photoaging markers in human keratinocytes. Extracts were produced using conventional acidified ethanolic extraction and Natural Deep Eutectic Solvents (NaDES), selected for their biocompatibility and environmental sustainability. while antioxidant capacity and cellular responses were assessed through in vitro assays in HaCaT cells. Preliminary results show that selected extracts significantly reduce intracellular ROS accumulation following H_2O_2 exposure, attenuate UVA-induced cytotoxic effects and promote wound-healing–related processes. These findings identify potato peel extracts as promising modulators of redox homeostasis and early photoaging pathways, within a sustainability-oriented valorization framework. Additional studies are needed to elucidate the underlying mechanisms and confirm their efficacy across extended biological models.

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P05 Poster Presentation

Green Extraction and Circular Valorisation of Grape Pomace: A Sustainable Source of Bioactive Compounds with antioxidant potential for Nutraceutical Applications

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In recent years, growing attention has been given to sustainable strategies for recovering bioactive compounds from agro-industrial by-products in line with circular economy principles. This study focuses on valorising grape pomace using subcritical water extraction, an eco-friendly method that uses only water, reducing hazardous solvents and improving resource efficiency. The optimization of extraction parameters enabled the production of fractions with distinct chemical profiles, among which SWE160.1, the extract obtained at the highest temperature used (160 °C) during the first 5 minutes of extraction, was particularly enriched in high-value phenolic compounds. SWE160.1 exhibited a selective cytotoxic activity on different cancer cell lines while preserving the viability of non-tumor human bronchial epithelial cells. In detail, the extract showed significant antioxidant potential in these cells, as demonstrated by its ability to counteract ROS generation, even under oxidative stress conditions, and to promote activation of the Nrf2/HO-1 axis. SWE160.1 maintained the upregulation of antioxidant enzymes even in the presence of LPS, supporting a specific role also in the anti-inflammatory response. Moreover, SWE160.1 counteracted stress granule formation following acute stress, reducing the possibility of converting these transient cytoplasmic granules into toxic aggregates. The dual activity, which combines anticancer potential with protective effects on healthy cells, supports its promising application as a source of health-promoting compounds for the development of innovative nutraceutical formulations. Overall, this study supports a sustainable model in which green extraction technologies enable the transformation of agro-industrial residues into high-value products.

P06 Poster Presentation

Active Biodegradable Packaging Based on PBS and Natural Oils: Improved Oxidative Stability and Shelf Life of Fresh-Cut Fruits

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The pervasive spread of microplastics and the escalating environmental burden of non-degradable materials represent urgent global challenges, intensified by population growth and unsustainable consumption patterns. In this context, the development of next-generation biodegradable materials is critical for advancing circular and sustainable food packaging systems. Herein, we report the design and characterization of innovative fully biodegradable bioplastic films based on polybutylene succinate (PBS), engineered to combine environmental compatibility with active food preservation functionality. To enhance the chemico-physical and functional performance of the polymer matrix, natural lipid additives extra virgin olive oil (EVO) and coconut oil (CO) were incorporated at varying concentrations (1, 2, and 3 wt%). Intermolecular interactions between PBS and the bio-based additives were investigated via attenuated total reflectance Fourier transform infrared (ATR-FTIR) spectroscopy, while the influence of oil incorporation on mechanical performance and thermal stability was systematically evaluated. Morphological features and film homogeneity were assessed through scanning electron microscopy (SEM). Importantly, the practical applicability of the developed materials was validated through real-food testing using fresh-cut apple and kiwi as model systems. Over a 12-day storage period, the films demonstrated a significant ability to retard oxidative browning and inhibit microbial spoilage. Notably, PBS films enriched with 3 wt% EVO exhibited the most effective preservation performance, preventing visible mold formation for up to 10–12 days. Overall, these findings highlight the potential of lipid-enhanced PBS-based bioplastics as sustainable, multifunctional alternatives to conventional petroleum-derived packaging, offering a promising strategy to simultaneously mitigate plastic pollution and extend food shelf life.

P07 Poster Presentation

Investigating the bone tissue differentiation potential of plumbagin in Dental Pulp Stromal/Stem Cell Cultures

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Oral stem cells, particularly dental pulp–derived stromal/stem cells (DPSCs), represent a promising resource for bone tissue engineering and regeneration, including approaches based on stimulation with osteogenic-inducing molecules. Plant-derived secondary metabolites with redox properties can influence stem cell pathways and drive phenotypic changes during differentiation. Evidence in the literature suggests that plumbagin (PB) may be a promising compound and a suitable agent for maintaining bone tissue homeostasis. However, knowledge regarding the relationship between human osteoprogenitor cells and PB remains limited. In this study, for the first time, priming or treatment with PB during the in vitro osteogenesis of DPSCs is investigated. Concentrations below 2 µM showed no cytotoxicity, consistent with other studies on stem cells that are likewise capable of differentiating into bone tissue. Notably, PB exhibited antioxidant properties, including enhancement of the endogenous defense system. The addition of PB to in vitro osteogenesis protocols was not sufficient to produce a consistent increase in the transition toward a mature osteocyte phenotype; however, early induction with PB acted as an osteogenic priming stimulus by increasing the levels of Runt-related transcription factor 2 (RUNX2), a transcription factor critical for specific fate decisions within the “mesengenic process.” These novel findings contribute to a better understanding of PB as a modulator of stem cell properties in the context of bone remodeling.

P08 Poster Presentation

PROTECTIVE ROLE OF HUMAN AND BOVINE MILK GLYCOSAMINOGLYCANS AGAINST METHYLGLYOXAL-INDUCED GLYCO-OXIDATIVE DAMAGE IN INTESTINAL CELLS

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Background: Glycosaminoglycans (GAGs) are bioactive components of human milk that reach largely intact in the intestinal lumen and they contribute to intestinal development and protection in early life. However, their role in counteracting glyco-oxidative stress induced by methylglyoxal (MGO) and advanced glycation end products (AGEs) remains unclear.

Objective: This study aimed to investigate the protective effects of GAGs isolated from human milk and bovine milk against glyco-oxidative damage induced by methylglyoxal (MGO) using intestinal epithelial cell models.

Methods: Human milk GAGs were tested at physiological concentrations. Bovine milk GAGs, heparin, and chondroitin sulfate were also evaluated. Protective effects were assessed in Caco-2 intestinal epithelial cells exposed to MGO by measuring cell viability, reactive oxygen species (ROS), transepithelial electrical resistance (TEER), and occludin expression.

Results: MGO exposure induced cytotoxicity, oxidative stress and disruption of epithelial barrier integrity. Co-incubation with GAGs significantly reduced cytotoxicity and ROS production, preserved epithelial integrity, and prevented the decrease in occludin expression.

Conclusions: Milk-derived GAGs exert a strong protective effect against MGO-induced glyco-oxidative stress and intestinal barrier dysfunction. These findings highlight their role as key functional components for maintaining intestinal homeostasis in early life and for improving the nutritional quality of infant formulas.

P09 Poster Presentation

Bioluminescent Yeast Biosensor for the Quantification of Urinary Caffeic Acid as Biomarker of Dietary Polyphenols Intake

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Dietary polyphenols are bioactive compounds associated with beneficial effects on human health, and high urinary levels have been linked to reduced mortality. Caffeic acid (CA), a major plant-derived phenolic acid, is a relevant biomarker of polyphenol intake and metabolism.

This study reports the development and validation of a novel yeast-based bioluminescent (BL) assay to detect and quantify CA and related phenolic metabolites in human urine.

Genetically engineered Komagataella phaffi yeast cells expressing enzymes of the fungal BL pathway were employed as a whole-cell biosensor, converting CA into luciferin and emitting light [1]. Calibration curves using CA standard solutions within physiological concentration ranges (0–10 µM) showed a good linear correlation in water and synthetic urine, with LOD of 0.05 ± 0.01 µM and 0.08 ± 0.02 µM and LOQ of 0.18 ± 0.02 µM and 0.24 ± 0.02 µM, respectively. Assay specificity and potential interference were evaluated using structurally related phenolics, tested individually and in mixtures. Among the tested compounds, only ferulic acid produced a detectable signal, showing additive effects with CA. As proof of concept, human urine samples were collected and processed before and after 5 days of green coffee extract supplementation (200 mg/day) to estimate CA levels, exhibiting a marked increase in BL signal compared to baseline, indicating enhanced urinary levels of CA and related metabolites.

P10 Poster Presentation

Impact of Extra Virgin Olive Oil Polyphenols on Skeletal Muscle under Stress and Inflammation

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Skeletal muscle function is essential for maintaining quality of life and is regulated by a balance between physiological processes and potential pathological factors, including oxidative stress and inflammation. Under physiological conditions, the production of reactive oxygen species (ROS) plays an adaptive role; however, their excessive accumulation, especially when associated with chronic inflammation, can impair muscle tissue integrity, promoting atrophy and mitochondrial dysfunction.

Nutrition represents a key preventive strategy. In particular, polyphenols — bioactive compounds found in plant-based foods and olive-derived products — exert antioxidant and anti-inflammatory effects by modulating key molecular pathways such as Nrf2 and NF-κB. Despite extensive evidence on various polyphenols, the role of extra virgin olive oil (EVOO) compounds, such as oleacein and oleocanthal, in skeletal muscle remains poorly explored.

The recent introduction of innovative extraction techniques, such as Natural Deep Eutectic Solvents (NaDES), has promoted the development of sustainable and efficient extraction methodologies, capable of producing concentrated and stable polyphenolic extracts. In this study, different NaDES formulations and solvent/oil ratios were tested to obtain extracts enriched in oleacein and oleocanthal. These extracta were characterized using the Folin–Ciocalteu assay and UPLC-DAD-MS analysis.

Biological effects were evaluated in C2C12 cells, focusing on proliferation, differentiation, and myotube maturation, as well as on the modulation of antioxidant and inflammatory responses under H_2O_2-induced oxidative stress. Preliminary results suggest a protective role of EVOO polyphenols in skeletal muscle function.

P11 Poster Presentation

A Novel Food-Derived Bioactive Extract Attenuates Lipid Accumulation in a Steatotic HepG2 Cell Model via AMPK Activation

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Metabolic dysfunction-associated fatty liver disease (MAFLD) represents a growing global health concern, strongly associated with obesity, insulin resistance, and cardiovascular risk. Despite its increasing prevalence, effective pharmacological therapies are still lacking, highlighting the need for novel nutritional strategies targeting key metabolic pathways.

In this study, we investigated the effects of a novel food-derived bioactive extract (currently under patent application) on hepatic steatosis in the human hepatocellular carcinoma cell line HepG2. Steatosis was induced by treatment with a mixture of palmitic and oleic acids,

leading to intracellular lipid accumulation. The bioactive extract was administered concomitantly with the steatogenic stimulus to mimic a preventive/therapeutic intervention.

Steatotic conditions reduced HepG2 cell viability compared to non-steatogenic controls. Treatment with the bioactive extract partially restored cell viability and markedly reduced lipid accumulation, as demonstrated by Oil Red O staining and cytofluorimetric analysis, showing a reduction in both the number and size of lipid droplets.

To investigate the underlying mechanism, AMPK pathway involvement was assessed. Treatment with the bioactive extract increased the phosphorylated (active) form of AMPK and increased the phosphorylated (inactive) form of acetyl-CoA carboxylase (ACC), suggesting enhanced fatty acid oxidation. The role of AMPK was further validated using the pharmacological activator AICAR and the inhibitor Compound C, confirming that the observed effects are mediated, at least in part, by AMPK activation.

In conclusion, the investigated bioactive extract effectively attenuates lipid accumulation and improves cell viability in a steatotic HepG2 model, with evidence supporting a key role for AMPK signaling. These findings highlight the potential of novel food-derived bioactive extract as promising nutritional strategies for the management of MAFLD.

P12 Poster Presentation

Natural Whey Starter-Derived Lactobacillus helveticus as a Source of Bioactive Peptides for Functional Fermented Milk

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Natural whey starter (NWS), used as an undefined starter culture in the production of Parmigiano-Reggiano PDO cheese, is a complex microbial ecosystem dominated by thermophilic lactic acid bacteria, including Lactobacillus helveticus, a species known for its high proteolytic activity and ability to generate bioactive peptides. The aim of this study was to evaluate the potential of L. helveticus strains isolated from NWS to hydrolyze milk proteins during cow's milk fermentation and release peptides with angiotensin I-converting enzyme (ACE)-inhibitory, antioxidant, and dipeptidyl peptidase IV (DPP-IV)-inhibitory activities.

Twenty-four Gram-positive, catalase-negative thermophilic lactic acid bacteria were isolated from four dairy farms sampled at two different time points (n = 4) and identified at the species level as L. helveticus by 16S rRNA gene sequencing. Genotyping by (GTG)5-PCR revealed 6 clusters and 3 singletons, supporting a high degree of bacterial diversity within the NWS community. Based on milk acidification and proteolytic performance after 48 h of fermentation in cow's milk, five strains showing the highest acidification and proteolytic aptitude were selected for longitudinal analysis of proteolytic degree, peptide release, and associated biological activities.

The selected L. helveticus strains showed marked variability in milk acidification rate, protein hydrolysis, peptide profiles, and associated biological functions. Among the tested strains, L. helveticus C007.10 exhibited the highest acidification rate and proteolytic activity and produced fermented milk with the highest antioxidant capacity after 48 h of fermentation (156.30 ± 6.25 mmol/L Trolox equivalents). In contrast, strain A005.15 produced fermented milk with the highest DPP-IV inhibitory activity at the same time point (IC_{50} 318.83 ± 25.94 µmol leucine/mL), despite its low acidification phenotype. UHPLC/HR-MS analysis revealed that all strains were highly proteolytic toward β-caseins, followed by αs1- and αs2-caseins, and were able to release a wide range of bioactive peptides. However, strain C007.10 also displayed proteolytic activity toward β-lactoglobulin and, to a lesser extent, α-lactalbumin. Overall, these results indicate that L. helveticus C007.10 is a promising functional culture to produce fermented milk enriched in bioactive peptides with potential health-promoting properties. The integration of fermentative, peptidomic, and in silico approaches supports the selection of functional dairy starter cultures for the development of foods with enhanced nutraceutical value.

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P13 Poster Presentation

Protective role of Tuber Borchii extracts against galactose-induced skeletal muscle sarcopenia in C2C12 myotubes.

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Sarcopenia is a progressive loss of skeletal muscle mass associated with both pathological conditions—such as neurodegenerative diseases—and physiological aging. It reduces muscle strength and mobility, impairing quality of life, and is directly associated with the frailty index, making it a predictive factor for disease prognosis. One of the pillars of muscle loss is the activation of the ubiquitin-proteasome system (UPS), with upregulation of the muscle-specific E3 ligases Atrogin-1 and MuRF1, which accelerate the degradation of contractile proteins [1]. Current therapeutic approaches are mainly preventive and based on physical activity; however, these interventions are not always feasible.

This study focused on identifying a novel anti-sarcopenic strategy with both preventive and therapeutic potential. We have previously demonstrated the antitumor activity of Tuber borchii extracts [2], which, in myotubes, enhanced protein synthesis and turnover while reducing key atrophy markers induced by galactose treatment, such as MuRF-1. The protective effect is also evidenced morphologically: despite exposure to the sarcopenic stimulus, treated myotubes remain thicker and exhibit a larger cross-sectional area.

In conclusion, these findings highlight the therapeutic and preventive potential of Tuber borchii extracts, paving the way for novel anti-sarcopenia strategies applicable also when physical activity is not feasible.

P14 Poster Presentation

Menadione Hormetic Regulation of Ferroptosis in Breast Cancer

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Ferroptosis is an iron-dependent form of regulated cell death driven by lipid peroxidation and redox imbalance, increasingly recognized as a promising therapeutic vulnerability in breast cancer. Among redox-active compounds, menadione (vitamin K3) is known for its pro-oxidant properties and has also been described as an inducer of heme oxygenase-2 (HO-2), a constitutive enzyme involved in cellular redox homeostasis [1]. In this context, we aimed to investigate whether HO-2 induction by menadione could modulate ferroptotic stress and enhance cell death under ferroptosis-inducing conditions. To this end, three human breast cancer cell lines with distinct ferroptosis sensitivities were employed. Cells were treated with menadione alone or in combination with established ferroptosis inducers, including erastin and RSL3, across a range of concentrations. Notably, menadione exhibited a dose-dependent biphasic (hormetic) effect. At low concentrations, it conferred a protective effect against erastin-induced ferroptotic stress, suggesting activation of adaptive antioxidant responses. In contrast, at higher concentrations (30 μM), menadione markedly enhanced cytotoxicity compared to ferroptosis inducers alone, consistent with an exacerbation of oxidative stress and promotion of ferroptotic cell death. Overall, these findings highlight a context- and dose-dependent role of menadione in modulating ferroptosis in most sensitive breast cancer cells. Although preliminary, these results provide a rationale for further investigation into the use of vitamins and redox-active compounds as modulators of ferroptosis and as potential adjuvants in anticancer therapeutic strategies.

P15 Poster Presentation

Targeting Lipid Metabolism to Modulate Ferroptosis in Breast Cancer

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Dietary fatty acids (dFAs) play a critical role in modulating lipid metabolism and redox homeostasis, key determinants of ferroptosis susceptibility in cancer cells. Ferroptosis, an iron-dependent form of regulated cell death driven by lipid peroxidation, has emerged as a promising therapeutic vulnerability in breast cancer [1]. In this study, we investigated the impact of distinct dFAs on ferroptotic sensitivity in breast cancer cell lines. Three human breast cancer models with different ferroptosis sensitivities were employed: MDA-MB-231 and BT-549 (sensitive) and MCF-7 (resistant). Cells were treated with selected dFAs, alone or in combination with ferroptosis inducers (erastin, RSL3, ML162). Mechanistic studies were performed using inhibitors of key metabolic enzymes, including DGAT1, ACSL4, and PEPCK, alongside cytotoxicity assays and protein expression analyses [2]. DHA induced marked lipotoxicity across all cell lines, whereas EPA and AA

exhibited selective cytotoxic effects. In contrast, OA exerted a protective role, attenuating ferroptosis. Notably, PEPCK inhibition reduced RSL3-induced ferroptosis, suggesting its involvement in sustaining lipid peroxidation under pro-ferroptotic conditions. Basal protein analysis revealed significantly lower PEPCK and xCT levels in the ferroptosis-resistant MCF-7 cells compared with sensitive models, indicating their potential as predictive biomarkers. Overall, these findings highlight lipid metabolic remodeling as a key determinant of ferroptosis sensitivity in breast cancer and suggest that modulation of dietary lipid availability and associated metabolic pathways may represent a novel strategy to enhance ferroptosis-based therapeutic approaches.

P16 Poster Presentation

Mechanistic Insights into Gut Microbial Metabolites of Phenolic Compounds in Colorectal Cancer Revealed by Metabolomic Analysis

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Phenolic compounds are food-derived molecules that are extensively metabolized by the colonic microbiota into bioactive gut microbial metabolites (GMMs). In a previous study [1], we have demonstrated that some GMMs displayed anti-proliferative activity on Caco-2 and SW480 colon cancer cell lines.

Subsequently, the mechanisms of action were investigated using metabolomic analysis. Cells were incubated for 72 hours with selected GMMs at their IC50 values. Cytoplasmic extracts where then obtained and analysed by LC-MS, in comparison with untreated cells.

Results showed that, in SW480 cells, gallic acid exerted its anti-proliferative activity by down-regulating the production of phospholipids, and in particular phosphatidylcholine, and other intermediates involved in the phospholipid biosynthesis pathway. In contrast, hesperetin and eriodictyol exhibited similar mechanisms of action, characterized by an accumulation of amino acids used by tumour cells for energy purposes, along with an accumulation of citric acid and glycolytic intermediates, suggesting possible mitochondrial dysfunction and a metabolic shift toward glycolysis.

In Caco-2 cells, the mechanism of action of 3,4-dihydroxyphenylacetic acid (DHPA) was further investigated, revealing an accumulation of carnitine and long-chain fatty acids, consistent with inhibition of β-oxidation and consequent impairment of cell proliferation.

Further studies are required to validate these findings and clarify the exact mechanisms of anti-proliferative activity of GMMs on colon cancer cells.

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P17 Poster Presentation

Stage-dependent epigenetic and anti-inflammatory effects of sprouts, microgreens, and baby leaves of Broccolo nero: a multi-omics perspective for sustainable nutrition

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Broccolo nero (BN) extract of sprouts (SLs), microgreens (MLs), and baby leaves (BLs), are increasingly recognized as sustainable “superfoods” with potential benefits for human health and disease prevention [1]. Their rapid growth, low-input cultivation, and accessibility make them attractive for both producers and consumers, aligning with current priorities in sustainable nutrition. Despite growing interest, limited evidence exists on the molecular mechanisms underlying their anti-inflammatory effects, particularly at the level of gene regulation. In this study supported by ELIXIRxNextGenIt-1st NOA Call, we adopted an integrative multi-omics approach to investigate how phytochemicals derived from BN superfoods influence epigenetic and transcriptional processes associated with inflammation and oxidative stresses. Specifically, we analyzed transcriptomic profiles, DNA methylation patterns, and the levels of omega-3 fatty acids (linoleic acid, eicosapentaenoic acid, and docosahexaenoic acid) in tumorigenic (SKBR-3) cell models treated with SLs, MLs, and BLs extracts, compared to untreated controls. Preliminary findings reveal distinct gene expression and methylation signatures associated with the developmental stage of BN leaves, suggesting differential modulation of key genetic pathways involved in inflammation, oxidative metabolism, and cell survival. Further studies are warranted to elucidate the precise regulatory mechanisms, as well as the impact of phytochemical composition, bioavailability, and synergistic effects, to better translate these findings into dietary recommendations and functional food applications [2].

P18 Poster Presentation

Framework for proteome analysis of cyanobacteria biofilm shaped in hydrogel scaffold

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Biofilms represent a highly organized microbial lifestyle that enables adaptation to environmental fluctuations, enhances survival, and facilitates extracellular interactions [1]. Biofilm development involves cell specialization and is characterized by the expression of cell-surface and extracellular matrix-associated proteins, contributing to the biofilm's structural integrity and social interactions [2]. Previous studies have identified surface-associated, matrix, and secreted proteins as key structural and signaling components of cyanobacterial biofilms [3]. However, the proteomic characterization of these proteins remains challenging, particularly in three-dimensional scaffolded systems. Hydrogel scaffolding provides a hydrated three-dimensional matrix that mimics the native extracellular environment, preserves spatial organization, and supports retention of extracellular proteins for downstream proteomic analysis [4].

This work is aimed to establish a framework for proteome analysis of cyanobacterial biofilms grown within a hydrogel scaffold.

The workflow includes optimization of cyanobacterial growth conditions within the hydrogel, including hydrogel size and geometry affecting nutrient diffusion, pH and temperature optimization to support stable biofilm formation. For protein analysis, a procedure was developed to enable efficient trypsin permeation through the hydrogel matrix, allowing digestion of exposed proteins of the hydrogel-embedded cyanobacterial biofilm. Protein secretion and extracellular protein retention within the hydrogel scaffold were suggested by combining SDS-PAGE and HPLC analyses, thus paving the way for the MS identification of biofilm surfaceosome and secretome, proteins of the extracellular environment.