Alimentazione e Nutraceutica nella Gestione delle Malattie Croniche non Trasmissibili

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Questo meeting organizzato dalle sezioni regionali SINU e SINut insieme all'Istituto per la Ricerca e l'Innovazione Biomedica del Consiglio Nazionale delle Ricerche (IRIB-CNR) e dal Dipartimento di Scienze e Tecnologie Biologiche Chimiche e Farmaceutiche (STEBICEF) dell'Università degli Studi di Palermo (UNIPA) è un'occasione di confronto tra esperti e professionisti del settore delle scienze della Nutrizione e dell'Alimentazione. Saranno affrontate le tematiche di maggior impatto nel campo della nutrizione e della nutraceutica, con un'attenzione particolare al ruolo dell'alimentazione e dell'integrazione nella gestione delle malattie croniche non trasmissibili.

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Strategies to overcome transporter-mediated multidrug resistance in hepatocellular carcinoma by plant-derived natural compounds

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Hepatocellular carcinoma (HCC) is a highly malignant tumor that responds poorly to existing therapies. Multidrug resistance (MDR) is the most important factor for treatment failure in advanced stage HCC patients. The most studied drug efflux pump, contributing to MDR, is the P-glycoprotein (P-gp, MDR1). *MDR1* gene is overexpressed in tumor tissues of HCC patients who have become resistant to chemotherapy treatments, or in patients with innate resistance. We developed a new pharmacological approach based on two plant-derived natural compounds, acting as P-gp inhibitors, phytol and lupeol, combined with sorafenib or lenvatinib, two drugs clinically approved for the treatment of patients with advanced HCC and known to be substrates of P-gp. We evaluated the basal expression levels of P-gp mRNA in three HCC cell line models, HepG2, Huh7 and SNU475, which reflect the heterogeneity of primary HCCs. Real time-PCR results showed that HepG2 cells expressed high levels of P-gp, whereas the SNU475 cells had the lowest levels expression. When used as single agent phytol showed to be not cytotoxic in all HCC cell lines, whereas lupeol, used at dose $\geq$ 40 μM, reduced cell viability in Huh7 and SNU475 cells. Next, we examined the effects on cell viability of phytol or lupeol in combination with the chemotherapeutics sorafenib and lenvatinib. Combinations showed synergistic inhibitory effects on cell viability in Huh7 cells, additive effects in HepG2 cells and no effect in SNU475 cells. These results suggest that the two natural compounds lupeol and phytol may effectively overcome MDR in HCC cells and could be evaluated as adjuvants in HCC chemotherapy protocols, at least in a subset of HCC patients.

Keywords: hepatocellular carcinoma, drug resistance, efflux pumps, natural compounds.

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The potential of bioactive compounds from edible mushrooms in a natural strategy for neurological disorders

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The main disorders of the central nervous system are neurodegenerative diseases mainly characterized by functional loss or neuronal damage in specific brain areas due to protein accumulation. Among the most common and well-known are Alzheimer's disease and Parkinson's disease, or multiple sclerosis. Furthermore, neurological pathogeneses are also caused by mitochondrial dysfunction due to increased ROS production, mitochondrial dynamic dysfunction, altered mitochondrial membrane potential. Despite the great progress in the therapeutic and pharmacological fields, it is well-known that a cure has not yet been found. Problems relating, for example, to the ability to cross the blood-brain barrier, to mechanisms of resistance to therapeutic approaches or to the onset of side effects are well known. In this context, evidence is emerging to support nutraceutical approaches to support traditional therapies. Several bioactive molecules have been found within foods that exhibit promising therapeutic effects. Thus, our research aims to investigate the potential of medicinal mushrooms as sources of bioactive molecules with antioxidant, antibacterial, and anti-inflammatory properties. In this preliminary study, we selected six mushroom species*: Pleurotus eryngii, Agaricus bisporus, Lentinula edodes, Auricularia auricula-judae,* and *Tremella fuciformis*. The primary objective of this project is to develop a multi-functional dietary supplement that leverages the unique properties of each fungal species. By combining different mushrooms, we aim to create a synergistic formulation with enhanced biological activity, optimizing their individual functional benefits. The initial phase of the study involved the formulation of a protocol for the extraction of bioactive components using an alcohol-water solution. The extracts are currently being evaluated for their antioxidant, antibacterial, and anti-inflammatory effects to assess their potential role as therapeutic support.

Keywords: mitochondrial dysfunction, ROS, antioxidant, antibacterial, and anti-inflammatory

Funding: This research was supported by the project Emerging Infectious Diseases One Health Basic and Translational Research Actions addressing Unmet Needs on Emerging Infectious Diseases, INF-ACT, Spoke 1 (P.P.) and Spoke 5 (D.N.). Project number PE00000007, CUP B53C20040570005.

Neuroprotective Effects of Kumquat Against Obesity-Induced Neurodegeneration

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Kumquats are citrus fruits rich in polyphenols and essential oils, typically consumed whole, including the peel, which increases the intake of beneficial compounds. This study aimed to evaluate the potential neuroprotective effects of kumquat against obesity-induced neurodegeneration. Mice were divided into three groups: Lean (fed a standard diet), HFD (fed a high-fat diet), and HFD+K (fed an HFD supplemented with 5% lyophilized kumquat). After 24 weeks, brain atrophy, neurodegeneration (TUNEL assay), expression levels of pro- and anti-apoptotic factors (RT-PCR), Alzheimer's disease markers (PCR-array), and insulin signaling proteins (Western Blot) were assessed in the brains of the differently fed animals. Compared to the Lean and HFD+K groups, obese mice exhibited brain atrophy, increased apoptotic nuclei in the cerebral cortex, upregulation of pro-apoptotic factors (Fas-L, Bim, P27), and downregulation of anti-apoptotic factors (BDNF, BCL2). PCR-array analysis revealed that kumquat intake increased the expression of genes involved in neuronal cell signaling (e.g., Gnb5, Gng4, Gng5, Gng8, Gng10) and insulin regulation (e.g., Ide, Igf2, InsR) compared to the HFD group. Furthermore, a significant downregulation of genes involved in β-amyloid plaque generation (Apba3, Apbb1, Apoe, Gnb2, Prkcd), acetylcholine degradation (Bche), and inflammation (Clu) was observed in HFD+K mice compared to obese control animals. Additionally, kumquat consumption reduced central insulin resistance, as indicated by enhanced protein expression of Ins-R, pAKT, pGSK3B, and pSer-IRS1. In conclusion, the present results demonstrate that kumquat consumption is able to counteract HFD-induced neurodegeneration by reducing neuronal apoptosis, improving central insulin sensitivity and positively modulating Alzheimer's disease markers.

New functional bread with olive mill wastewater

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Agricultural wastes and food by-products often contain high concentrations of bioactive compounds. These wastes not only impose disposal costs on producers, but also pose environmental challenges. However, the recovery of these bioactive compounds is essential to promote a circular economy.
The aim of this study is to use olive mill wastewater (OOMW) as an ingredient for the production of functional bread, to reduce agro-industrial waste and improve the nutritional value of bread.
All the activities were carried out within the NODES project "Nord Ovest Digitale E Sostenibile", in particular in the SADAIFO - PLANT (Sustainable and digital innovation for foods of PALNT origin) within the PNRR
A multidisciplinary approach was used to determine the characteristics and evaluate their effects on the chemical and microbiological properties, antioxidant and sensory activities of the added bread. Therefore, sourdough propagation, dough production and baking, starch digestibility of breads, volatile compounds by HS-SPME-GC/MS, LC-MS/MS analysis of major polyphenols in breads, antioxidant activity and sensory analysis were evaluated.
In addition to a traditional bread as a “control”, two types of bread were produced using 50% OOMW and 50% sterile tap water and a third using 100% OOMW.
These results highlight the significant role of mill wastewater in enriching the polyphenol content and improving the flavour profile, ultimately turning the final product into a functional food with additional health benefits.

Keywords: functional bread; olive mill wastewater; polyphenols; SPME-GC/MS; LC/MS

Antioxidant capacity of olive pomace and citrus peels: New strategies to improve quality of gluten-free foods

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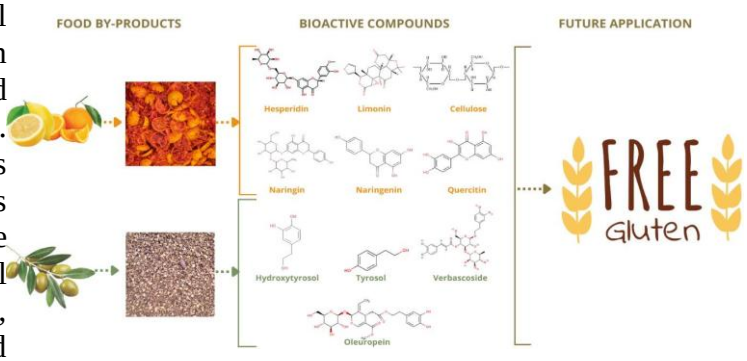
In recent years, the rise in celiac disease has led to an increase in the production of gluten-free food products based on maize and rice flours. These products are characterized by a high glycaemic index and a low supply of bioactive compounds, limiting their nutritional benefits. A promising solution is the valorisation of agro-industrial by-products, such as olive pomace and citrus peel, rich in polyphenols and natural antioxidants, to develop healthy gluten-free foods.

Extracts were obtained from olive pomace and citrus peels, using ethanol/water (80:20% v/v) with and without sonication. After 24 hours, the olive pomace sample was centrifuged. Samples were then evaporated in a Rotavapor for a further 24 hours, after which stock solutions were prepared in PBS. Antioxidant capacity (Ferric ion reducing antioxidant power - FRAP) and polyphenol content (Folin-Ciocalteu), were analysed. Yields for 5 g of samples for each protocol (sonicated and non-sonicated) were ± 110 mg for orange peels, ± 87 mg for lemon peels, and ± 92 mg for olive pomace. FRAP and Folin-Ciocalteu analyses confirmed a high antioxidant capacity and a significant polyphenol content, suggesting a strong bioactive potential.

Preliminary results suggest that these by-products may represent a valuable source of bioactive compounds with potential health benefits. Further studies on intestinal cells (Caco2) will assess polyphenol absorption and its effect in modulating oxidative stress and inflammatory response. Incorporating these extracts into gluten-free food products could contribute to the improvement of nutritional quality and, at the same, promote sustainability and circular economy.



Keywords: Celiac disease, by-products, bioactive compounds, functional foods, health benefits.

Prebiotic potential of innovative functional pasta enriched with inulin

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In order to satisfy the consumer's request for a healthier diet, the food sector is constantly investing in the development of functional foods, fortified with prebiotic substances, known for their beneficial effects on the gut microbiome. Among prebiotics, inulin has a particular structure that avoid its hydrolyzation by the human enzymes in the gastrointestinal tract.
In the present study, an innovative pasta enriched with 12% (w/w) inulin from chicory was characterized for biochemical and technological properties, in comparison to a control pasta (CTRL) without inulin. Results demonstrated that the incorporation of inulin in pasta formulation positively affected some organoleptic properties and cooking quality of the final product, giving an overall score higher than CTRL. The essential amino acid content remained comparable between the two pasta samples, while the total protein content was reduced in enriched pasta due to polymer substitution to durum wheat flour. The prebiotic activity of inulin was firstly tested through *in vitro* kinetic experiments with seven probiotic strains. Among them, *Lacticaseibacillus paracasei* IMPC2.1 was selected for the simulated gut fermentation studies. The enriched pasta exhibited a positive prebiotic activity score, indicating its potential as a prebiotic source. Notably, it promoted the growth of the IMPC2.1 and the production of short chain fatty acid, to a higher extent than CTRL and similarly to glucose or fructo-oligosaccharides. Further research should explore the impact of the degree of polymerization of inulin on gut microbiota modulation, improving intestinal health benefits.

Keywords: functional foods, prebiotic substances; inulin; *Lacticaseibacillus paracasei* IMPC 2.1; SCFA.

Neurogastronomy: An Innovative Multisensory Strategy for Neurological Disorders

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Neurological disorders have reached an unprecedented global scale, posing a significant challenge to public health. Various approaches have been explored to mitigate this issue. While pharmacological treatments have proven highly effective, their use is often hindered by side effects and the risk of habituation. On the other hand, dietary interventions alone have not demonstrated sufficient efficacy in addressing brain-related conditions. However, combining natural bioactive compounds with pharmacotherapy has shown promising results in improving patient outcomes. Consequently, researchers are increasingly focusing on integrative strategies to tackle neurological diseases. One emerging avenue involves the application of sensory neuroscience to gastronomy, offering a novel, non-invasive method to stimulate brain function. Sensory stimulation through food, along with herbal and traditional medicine, may activate specific neural pathways, fostering neurostimulation. By integrating taste, sight, touch, and sound with bioactive-rich foods, this approach could serve as a complementary therapy for individuals with neurological disorders. This review is the first to delve into this innovative intersection of neuroscience and gastronomy, paving the way for future research in the field.

Keywords: Neurogastronimy, foods, bioactive molecules, sensory neuroscience, vulnerable populations.

Extra-Virgin Olive Oil phenols attenuate lipid accumulation in *in vitro* hepatic steatosis models

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Non-alcoholic fatty liver disease (NAFLD) is an emerging issue for global health with increasing incidence and is becoming a main risk factor for the development of hepatocellular carcinoma (HCC). Oleacein (OL) and hydroxytyrosol (HT) are minor phenolic compounds present in EVOO. They are strong antioxidants and radical scavengers, with proved health properties. HepG2 and Huh7 cells were exposed to a 3:2 oleate/palmitate fatty acid (FA) mixture, as this ratio recapitulates the amount of dietary fat involved in the development of steatosis in humans. Lipid droplets accumulation was evaluated by Oil Red O and Bodipy staining, in the presence/absence of the selected phenols. Western blotting analysis was conducted to investigate the molecular mechanisms involved in steatosis induction/protection. Treatment of HepG2 and Huh7 cells with FA mixture in the presence of OC, OL and HT reduced the number of intracellular lipid droplets after FA exposure. At the molecular level, in Huh7 cells, FA treatment in the presence of HT reduced the expression levels of fatty acid synthase (FASN) and acetyl-CoA carboxylase alpha (ACACA), two key enzymes responsible for *de novo* lipogenesis (DNL). In HepG2 cells, HT treatment increased phosphorylation levels of AMP-activated protein kinase (AMPK), a kinase involved in the inhibition of DNL and increased the expression of peroxisome proliferator-activated receptor α (PPARα), a protein implicated in fatty acid oxidation processes.
These findings highlighted the ability of OC, OL and HT to interfere with lipid metabolism, supporting the importance of EVOO and its phenols in a healthy diet.

Keywords: NAFLD, Liver, fatty acids, natural compounds.

Exploring the Potential of Carob (*Ceratonia siliqua L.*) in Functional Food Production

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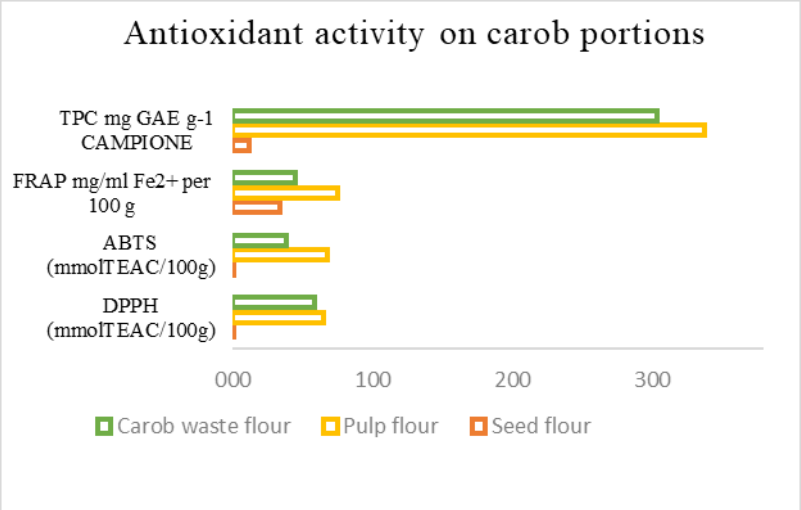
Carob-based functional foods have recently gained considerable consumer interest as natural and sustainable alternatives due to their remarkable nutritional profile and associated health benefits[1]. These products are obtained from the pods of *Ceratonia siliqua L.*, a tree native to Mediterranean regions, and are naturally sweet, caffeine-free and rich in bioactive compounds such as polyphenols, dietary fibre and essential minerals[2]. This work explores the potential of carob for the development of functional foods, focusing specifically on the analysis of carob seed flour, carob pulp flour, and flours obtained from by-products of primary carob processing.

Preliminary analyses were based on the determination of total polyphenols (TPC) by Folin ciocalteau test and antioxidant activity by DPPH, ABTS and FRAP assays. Among the analysed samples, the pulp flour showed the highest TPC (337.86 mg GAE/g) and antioxidant activity (DPPH: 65.03 mmol TEAC/100g; ABTS: 67.64 mmol TEAC/100g; FRAP: 75.18 mg/ml Fe^{2+}), followed by carob waste flour (TPC: 303.80 mg GAE/g; DPPH: 58.00 mmol TEAC/100g; ABTS: 38.47 mmol TEAC/100g; FRAP: 44.78 mg/ml Fe^{2+}). In contrast, seed flour showed significantly lower values in all parameters. These results highlight the potential of carob derivatives as valuable ingredients for functional food production, promoting both nutritional improvement and sustainable use of agro-industrial by-products. The high content of bioactive compounds in carob and its components makes it an innovative ingredient with potential applications in a wide range of health-beneficial food products, warranting further research to fully explore its nutritional and industrial potential.



Keywords: antioxidants; fibers; gut-health; polyphenols; food industry.

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Myelin nanovesicles as brain delivery systems for natural molecules: a novel nutraceutical approach

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Natural molecules exhibit a wide range of biological activities and molecular targets, making them promising candidates for the development of clinical treatments for various diseases. However, their therapeutic potential is often hampered by several challenges, including solubility, bioavailability, stability, short duration of action and inability to cross biological barriers. In particular, the blood-brain barrier and the blood-cerebrospinal fluid barrier limit access to the brain, reducing the efficacy of brain-targeted therapies. To address these challenges, nanoscale delivery systems have emerged as a promising solution to overcome these limitations. In this context, we propose an innovative therapeutic strategy involving the bio-fabrication of myelin-based nanovesicles (MyVes). MyVes, produced by nanoprecipitation and microfluidics, have a spheroidal shape, a diameter of about 100 nm, a negative zeta potential and naturally contain myelin proteins. In addition, MyVes can be loaded with natural molecules using either passive or active molecular loading techniques. Furthermore, MyVes have an enhanced tropism for microglial cells, which play a role in the neuroinflammatory process associated with many brain diseases. Therefore, we propose the use of natural molecules encapsulated in nanovesicles as a novel nutraceutical approach targeting the central nervous system.

Keywords: MyVes, myelin proteins, multiple sclerosis, nanovesicle.

Funding: This research was supported by the project Emerging Infectious Diseases One Health Basic and Translational Research Actions addressing Unmet Needs on Emerging Infectious Diseases, INF-ACT, Spoke 1 (P.P.) and Spoke 5 (D.N.). Project number PE00000007, CUP B53C20040570005.

Prangos ferulacea, in the sheep diet and its impact on the production of raw milk and ricotta cheese

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The aim of the study was to evaluate the effects of a forage plant, *Prangos ferulacea*, in the sheep diet and its impact on the production of dairy products. Specifically, the chemical, microbiological, and sensory characteristics of raw milk, whey, and ricotta were evaluated.
All activities were carried out within the NODES project "Nord Ovest Digitale E Sostenibile," specifically in the SADAIFO - ANIMAL (Sustainable and Digital Innovation for Food of ANIMAL Origin) under the PNRR.
Prangos ferulacea is a plant that grows spontaneously in the Madonie area and can play an important role as a forage plant. P. ferulacea is rich in phenolic compounds and flavonoids, which are useful against oxidative stress, thus contributing to the prevention of cell damage. A multidisciplinary approach was used to determine the ecological characteristics of the species, investigate its forage value, and evaluate its effects on the chemical and microbiological properties of raw milk and ricotta.
Extracts obtained from *P. ferulacea* show significant antimicrobial activity against various bacteria and fungi, suggesting its potential use as a natural antimicrobial agent. The most important compounds in *P. ferulacea* are monoterpenes, sesquiterpenes, and terpenoids, some of which possess antimicrobial, calming, and insect-repellent properties.
The integration of *P. ferulacea* in the ovine diet may represent a promising strategy to enrich the aromatic profile and the content of bioactive compounds in dairy products, offering opportunities for diversification and valorization of dairy production.
The results highlighted the potential of *P. ferulacea* to improve cheese quality, antioxidant properties, and overall dairy production.

Keywords: *Prangos ferulacea*, milk, ricotta cheese, phenolic compounds and microbiological properties

Potential benefits of Extra Virgin Olive Oil Polyphenol Enriched Extracts on Peripheral Blood Mononuclear Cells from Rheumatoid Arthritis patients.

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Rheumatoid Arthritis (RA) is one of the most prevalent chronic inflammatory diseases manifested by elevated oxidative stress and inflammatory biomarkers. While current RA therapies have significantly improved the course of the disease, there is still an urgent need for novel approaches that can better target the underlying pathogenetic mechanisms and reduce side effects. Extra virgin olive oil (EVOO) is one the main components of the healthy Mediterranean diet that possesses anti-oxidant and anti-inflammatory effects due to the presence of different polyphenols. In our study we analyzed the chemical composition of Sicilian Extra Virgin Olive Oil Polyphenols-Enriched Extracts (PE-EVOOs) by HPLC/ESI/Q-TOF, identifying the most represented phytomolecules. Interestingly, we demonstrated that PE-EVOOs are capable of reducing intracellular ROS and pro-inflammatory cytokines TNF-α and IL-1β in peripheral mononuclear cells (PBMCs) obtained both from RA patients and lipopolysaccharides (LPS) treated healthy subjects (HS) as control. The analysis of the mechanisms underlying PE-EVOO antioxidant and anti-inflammatory effect in RA and HS PBMCs highlighted that these extracts are capable of both inhibiting NF-kB and activating Nrf2, the master regulator of cellular antioxidant defenses. We believe that this study opens the way to the employment of PE-EVOOs as an adjuvant to conventional RA therapies, contributing to improve overall treatment outcomes.

Keywords: rheumatoid arthritis; PBMCs; Extra Virgin Olive Oil polyphenols; IL-1β, TNF-α.

Response of Aeroponically Cultivated Baby-Leaf Lettuce (Lactuca sativa L.) Plants with Different Zinc, Copper, Iodine, and Selenium Concentrations

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Over two billion people worldwide suffer from micronutrient deficiencies. Biofortifying vegetables can enhance micronutrient intake through the diet. This study assessed the biofortification of indoor-grown baby-leaf lettuce using aeroponics. Four experiments, two each, were conducted by adding different concentrations of Zn (from 10 to 450 µM) or Cu (from 3 to 250 µM) into a nutrient solution. A fifth experiment was conducted by simultaneously adding to the nutrient solution the optimal concentration of I (5 µM) and Se (13 µM), chosen on the basis of previous works, and the optimal concentration of Zn (250 µM) and Cu (150 µM), chosen on the basis of the results obtained in the first four experiments. Leaf biomass, mineral concentrations, chlorophylls, carotenoids, phenols, flavonoids, nitrates, and antioxidant capacity were measured 21 days after transplanting. Higher concentrations of Cu, Zn, I, or Se in the nutrient solution led to an increase in their concentrations in lettuce leaves, without affecting the growth or leaf quality of lettuce plants. The simultaneous application of I with the other elements induced a higher accumulation in leaves compared to when I is applied alone. One hundred grams of lettuce leaves biofortified with Se, I, Cu, and Zn would provide the 6.1%, 35.3%, and 263.0% of Adequate Intake for Cu, Se, and I, respectively, and 4.5% of Population Reference Intake for Zn. Our results suggest that simultaneously biofortifying babyleaf lettuce with these four minerals is possible without reducing lettuce yield or quality.

Table 2. Percentage of adequate intake (AI), for Se, I, and Cu, or of population reference intake (PRI), for Zn, satisfied by the consumption of 100 g of fresh leaves (FW) of lettuce plant grown indoors, in aeroponics, with different concentrations of Cu, Zn, I, and Se in the nutrient solution, and the amount of FW that would provide the 100% of AI, for Se, I, and Cu, or 100% of PRI, for Zn.

Experiment	Treatment		Concentration (µM)	% AI or % PRI per 100 g FW	g FW 100% AI or PRI
Cu_1	Control	Cu	3	3.20	3154.6
	Cu.25		25	4.70	2131.2
	Cu.50		50	7.81	1319.0
	Cu.75		75	5.20	1929.3
Cu_2	Control	Cu	3	3.09	3333.4
	Cu.150		150	6.04	1672.0
	Cu.200		200	6.49	1553.6
	Cu.250		250	6.25	1616.6
Zn_1	Control	Zn	10	2.73	3677.0
	Zn.50		50	3.65	2750.4
	Zn.100		100	4.74	2109.6
	Zn.150		150	4.71	2133.1
Zn_2	Control	Zn	10	3.18	3167.6
	Zn.250		250	5.55	1805.1
	Zn.350		350	4.62	2172.3
	Zn.450		450	5.42	1863.3
Mix	Control	Cu	0	2.33	4368.5
		Zn	0	2.37	4274.6
		Se	0	0	-
		I	0	0.83	15,655.1
	Se.13	Se	13	35.79	279.9
	I.5	I	5	101.89	99.8
	Mix	Cu	150	6.12	1656.8
		Zn	250	4.48	2249.2
		Se	13	35.32	284.8
		I	5	262.9	38.2

Keywords: biofortification; soilless farming; indoor cultivation; leafy vegetables.

EDO RADICI FELICI

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EDO Radici Felici Srl, an innovative SME, operates in the agricultural sector with activities aimed at process and product innovation: it develops, designs, and implements cultivation systems with aeroponic technology for the production of high-quality vegetables. The aeroponic technique is a closed-cycle soilless system of plant development in a greenhouse without the use of soil or any other supporting aggregate. The plants are fed by water misting systems enriched with mineral fertilizers, which are digitally and automatically managed to directly nourish the plant roots. The company combines the peculiar characteristics of aeroponic technology with the application of agronomic biofortification techniques for the enrichment of vegetables with functional minerals, elements present in the EFSA Regulation (EU) No. 432/2012. The vegetables obtained, rich in bioactive substances (phytocompounds), when consumed daily as part of a varied diet, help modulate the immune system and reduce the risk of chronic diseases associated with aging. The company validated this technique in collaboration with the DiSAAA-a of the University of Pisa, and obtaining patents no. 102019000020895/2019 and 102022000014098/2022, subject to a European extension application (EP23722092.6). The results of co-financed research projects on the biofortification of plants with the aeroponic system are published in the scientific journal Horticulturae:

"Effects of Individual and Simultaneous Selenium and Iodine Biofortification of Baby-Leaf Lettuce Plants Grown in Two Different Hydroponic Systems" (https://doi.org/10.3390/horticulturae7120590);
"Response of Aeroponically Cultivated Baby-Leaf Lettuce (Lactuca sativa L.) Plants with Different Zinc, Copper, Iodine, and Selenium Concentrations (https://doi.org/10.3390/horticulturae10070726).
Other ongoing projects include:
FOSC – Food Systems and Climate SECUREFOOD2050 "Improving resilience and food security in 2050 climate through soilless precise agricultural techniques and irrigation with wastewater properly treated by innovative technologies to ensure food safety";
"Innovative system based on submicrometric particles, for the biofortification of plants, designed to increase the content of vitamin B12 (cyanocobalamin) in plant products".

Keywords: Aeroponic; Dietary supplement; Functional food; Soilless culture

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EUPSICHE APS

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L'associazione Eupsiche APS, nata nel 1998, promuove il benessere psicosociale degli individui, gestendo attività di consulenza e progettazione nel settore dei servizi alla persona, realizzando interventi psico-sociali ed educativi di prevenzione primaria ed educazione alla salute, rivolti a organizzazioni pubbliche e private.

Educare al Gusto della Sana Vita è un progetto che promuove corretti stili di vita mediante educazione alimentare, ambientale e relazionale. Realizzato nel 2023/2024 all'interno della Regione Siciliana dall'associazione APS Eupsiche

Keywords: Educazione, Dieta Mediterranea, self-empowerment, benessere psicosociale, alimentazione

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Met4Health

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Met4Health is an innovative start-up founded in 2024.

It was born from the desire to clarify the health benefits of nutritional supplements through an innovative omics technique: Nuclear Magnetic Resonance (NMR) metabolomics.

Met4Health's aim is to enable companies that produce dietary supplements to know exactly how their product works through a single metabolomics study, reducing costs and enriching the health benefits of supplements.

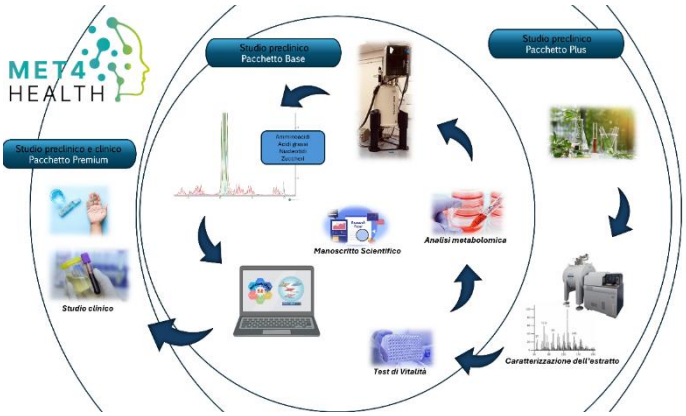
Metabolomics is part of the omics sciences, all the sciences that study complex biological systems and their dynamics. Metabolomics provides an accurate and complete snapshot of what is happening in biological systems by mapping all the small molecules called metabolites in tissues, biofluids and cells. Every substance we ingest and every biological factor we encounter can affect our metabolites and their biochemical pathways. Through metabolomics, it is possible to understand what is happening and what scenario might emerge.

Metabolomics is therefore a powerful tool to reveal what we do not know and to provide evidence to support what we do know.

The NMR metabolomics approach used by Met4Health has the advantage of being non-destructive, quantitative and highly reproducible.

We will use this innovative technique to demonstrate what companies expect from their supplements and, more importantly, to discover what they have not yet imagined.

We will provide product validation to clarify health benefits of supplements, giving an additional value to nutraceutical manufacturing companies and their products. Met4Health offers different packages ranging from *in vitro* analysis of cell cultures to clinical studies, according to the customer needs (see image below).



Met4Health is metabolomics for health and well-being.

Keywords: ^{1}H-NMR Metabolomics, B2B services, validation, supplements, personalized medicine.

https://www.met4health.com/

NORSAN

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NORSAN: Towards the re-nutritionalization of omega-3 fatty acids

NORSAN is a Norwegian company of food supplements based on omega-3 fatty acids of marine origin (from fish or algae), with a focus on quality, purity and sustainability. Founded with the aim of promoting health and well-being through a conscious and effective intake of Omega-3, NORSAN stands out for the use of natural raw materials and responsible production methods. Norsan's goal is also to inform professionals and educate consumers on the role of omega-3 fatty acids for our health.
NORSAN products are developed keeping the formulation as close as possible to the original food: high natural concentration of EPA and DHA (fatty acids in the form of triglycerides), maintenance of all the fatty acids present in the source, addition of organic extra virgin olive oil. Thanks to the use of fish oils certified from sustainable fishing (Friend of the Sea certification) and vegetable oils derived from ethically cultivated algae, the company combines effectiveness and respect for the environment.
Each batch is rigorously tested to ensure maximum purity, absence of contaminants and a pleasant taste, thanks to advanced purification processes (IFOS certified) and the addition of natural flavors that guarantee no return of flavor. The product range includes liquid, capsule or jelly options.
With a constant commitment to sharing scientific culture, NORSAN seeks to raise awareness of the importance of achieving an adequate quota of omega-3 levels circulating in the body. Today, NORSAN is synonymous with innovation and responsibility in the natural health sector.

Keywords: omega-3, omega-3 Index, EPA, DHA, nutrition

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NUTRIGEA

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Nutrigea

Fondata dal Dr. Stefano Scoglio nel 1998, Nutrigea nasce con l'obiettivo di promuovere la Nutriterapia Primordiale, un approccio innovativo che integra nutrizione e nutraceutica naturale.

Missione

Il progressivo impoverimento dei terreni agricoli e la lavorazione industriale degli alimenti hanno portato a cibi poveri di nutrienti essenziali, indebolendo la nostra capacità naturale di difesa. Nutrigea risponde a questa sfida attraverso i supercibi primordiali, fonti naturali e complete di nutrienti che il corpo riconosce e utilizza per restaurare l'immunità naturale e prevenire le malattie.

Soluzioni innovative

I prodotti Nutrigea si basano su microalghe, probiotici ed enzimi, con una particolare attenzione all'alga selvatica *Aphanizomenon flos-aquae* (Alga Klamath), ai batteri probiotici DDS-1, e agli enzimi ad ampio spettro. Gli estratti brevettati AphaMax® e Klamin®, derivati dalla Klamath, concentrano molecole nutraceutiche essenziali, come feniletilammina e afa-ficocianine, con proprietà antinfiammatorie, neuroprotettive e regolatrici dell'umore.

Evidenze scientifiche

In collaborazione con università e centri di ricerca, tra cui l'Università di Urbino e il CNR di Palermo, Nutrigea ha condotto studi clinici e di laboratorio che dimostrano i benefici degli estratti in ambiti quali: carenza di vitamina B_{12}, depressione, ansia, patologie infiammatorie (psoriasi, fibromialgia) e sindrome metabolica.

Grazie a queste scoperte, Nutrigea rappresenta un alleato prezioso per il supporto nutrizionale e la prevenzione, integrandosi efficacemente con terapie mediche tradizionali.

NUTRIGEA®
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Parole chiave: Nutrigea, Klamath, Klamin, AphaMax, Nutriterapia

Ringraziamenti e Conclusione

Desideriamo ringraziare tutti coloro che hanno contribuito alla realizzazione di questo congresso e alla pubblicazione del presente eBook degli abstract. Un sentito grazie ai relatori, ai partecipanti, alle aziende sponsor e a tutti i membri del comitato scientifico e organizzativo per il loro impegno e supporto.

Ci auguriamo che questo evento sia stato un'opportunità di crescita e confronto per tutti i professionisti del settore, promuovendo nuove prospettive di ricerca e applicazioni nel campo della nutrizione e della nutraceutica.

Grazie per aver preso parte a questa iniziativa. Ci vediamo ai prossimi appuntamenti scientifici!

Il Comitato Organizzatore

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