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Ministero dell'Università e della Ricerca

Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA

VITALITY

MISSIONE 4 - Istruzione e Ricerca

SPOKE 6 - Innovazione e sicurezza degli ambienti di vita nell'era digitale e verde

WP5 - Valorisation of typical regional food for the improvement of health and well-being of consumers through an innovative nutraceutical and nutrigenomic approach
Project RESCUE-Bio:
Companies Pierpaoli Srl, SYNBIOTEC Srl
Project H.E.A.R.T.:
Company Nautes Spa

VITALITY SPOKE 6

Work Package 5

UNICAM Università di Camerino 1336

1506 UNIVERSITÀ DEGLI STUDI DI URBINO CARLO BO

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WP 5

UNICAM, WP5 spoke 6 WP leader: Sauro Vittori
UNIURB, WP5 spoke 6 WP cp: Elena Barbieri

Task	Unicam - Uniurb	
Task 1	Maggi - Lucarini	**Characterization of macro- and micronutrients, bioactive compounds and flavors, in selected typical food and aromatic plants of Marche Region**
Task 2	Silvi – Albertini	**Evaluation of the ability to induce well-being and health by food and plant extracts and their constituents**
Task 3	Vittori – Formica	**Recovery of valuable compounds from food by-products**
Task 4	Caprioli – Fraternale	**Development of nutraceuticals and functional foods**
Task 5	Gabbianelli – Amatori	**Gene expression regulation, Cancer, Molecular pathology**
Task 6	Polzonetti - Grappasonni De Santi - Barbieri	**Personalized strategies for a healthy diet and increase of citizen's awareness**

Vitality, Next Generation EU—PNRR MUR project ECS_00000041- VITALITY

- **Work Package 5 – Valorization of typical regional food for the improvement of health and well-being of consumers through an innovative nutraceutical and nutrigenomic approach**

WP's activities

Identification of regional food, plants, food waste & by-products, and lignocellulosic biomass

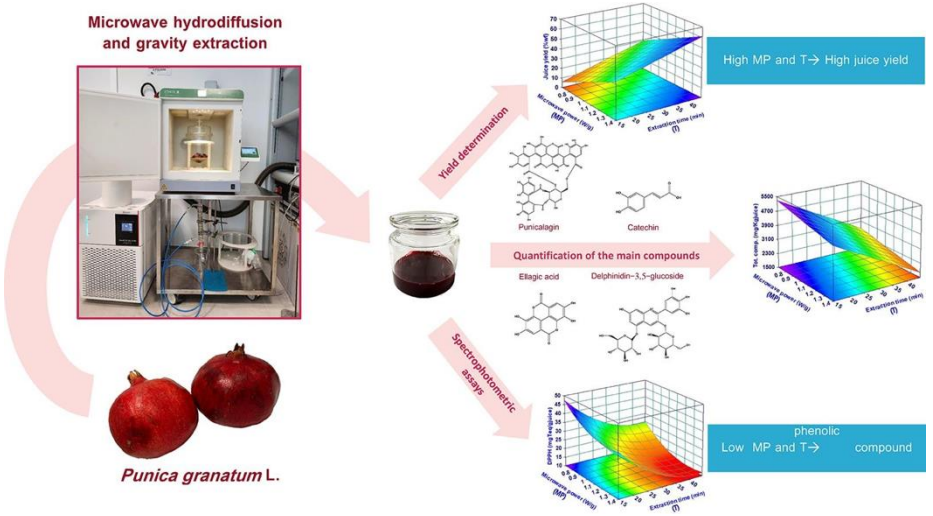
task 5.1, 5.3

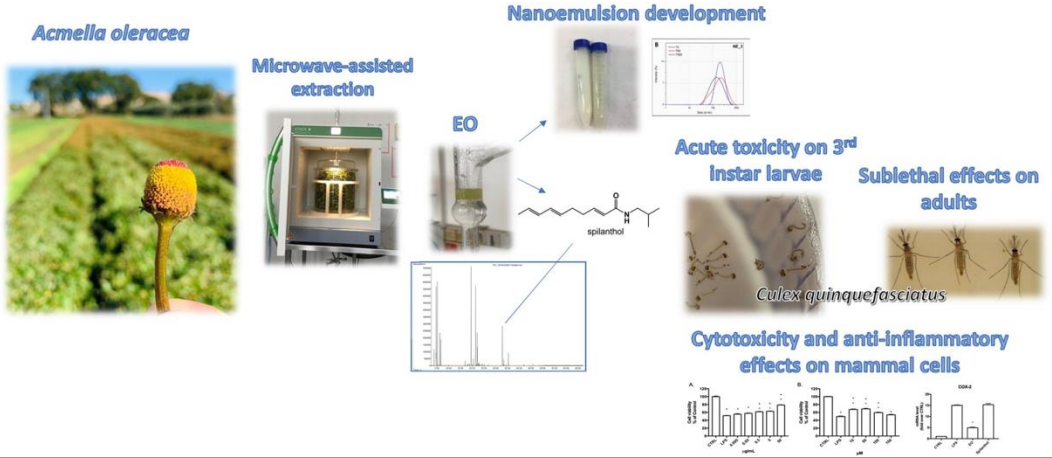
Optimization and application of the different extraction methods/technologies

task 5.1, 5.3

Characterization of the obtained extracts (bioactive compounds, antimicrobial activity, functional activity and biological activities)

task 5.1, 5.2, 5.3





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task 5.1, 5.3

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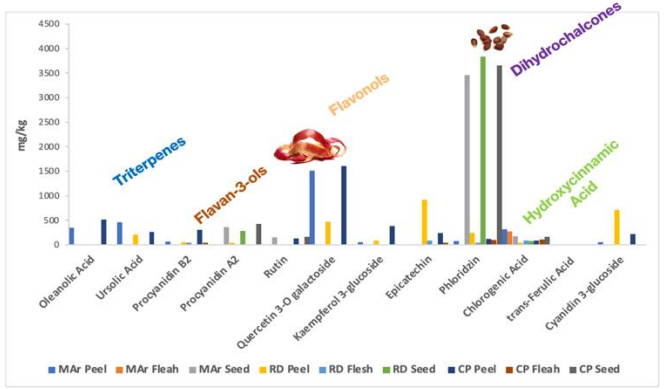
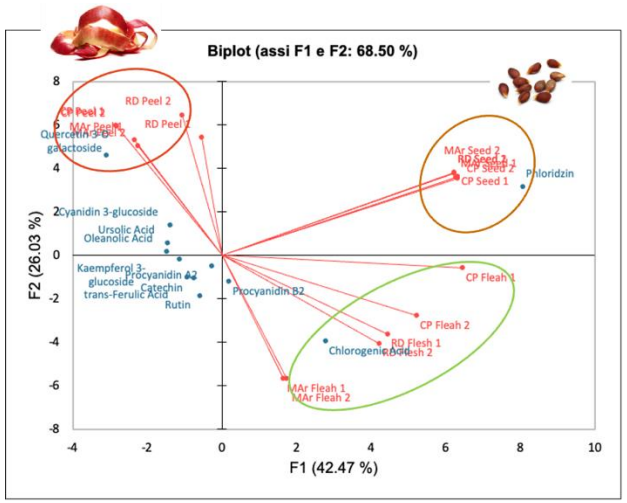
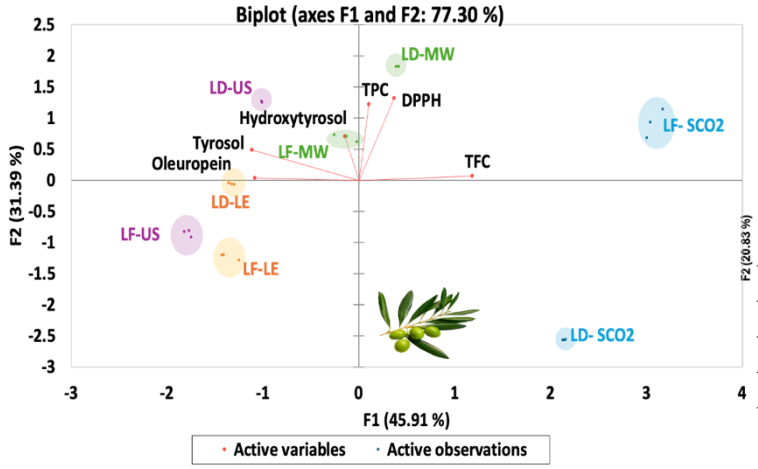
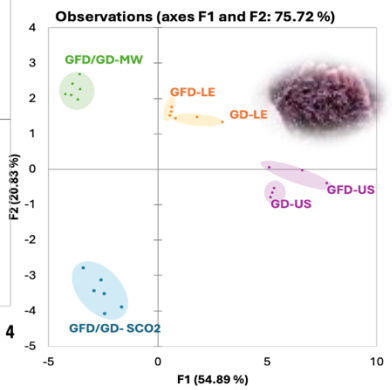
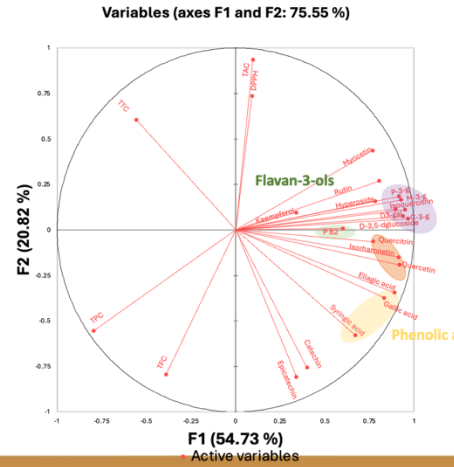
Results











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- **Work Package 5 – Valorization of typical regional food for the improvement of health and well-being of consumers through an innovative nutraceutical and nutrigenomic approach**

WP's activities

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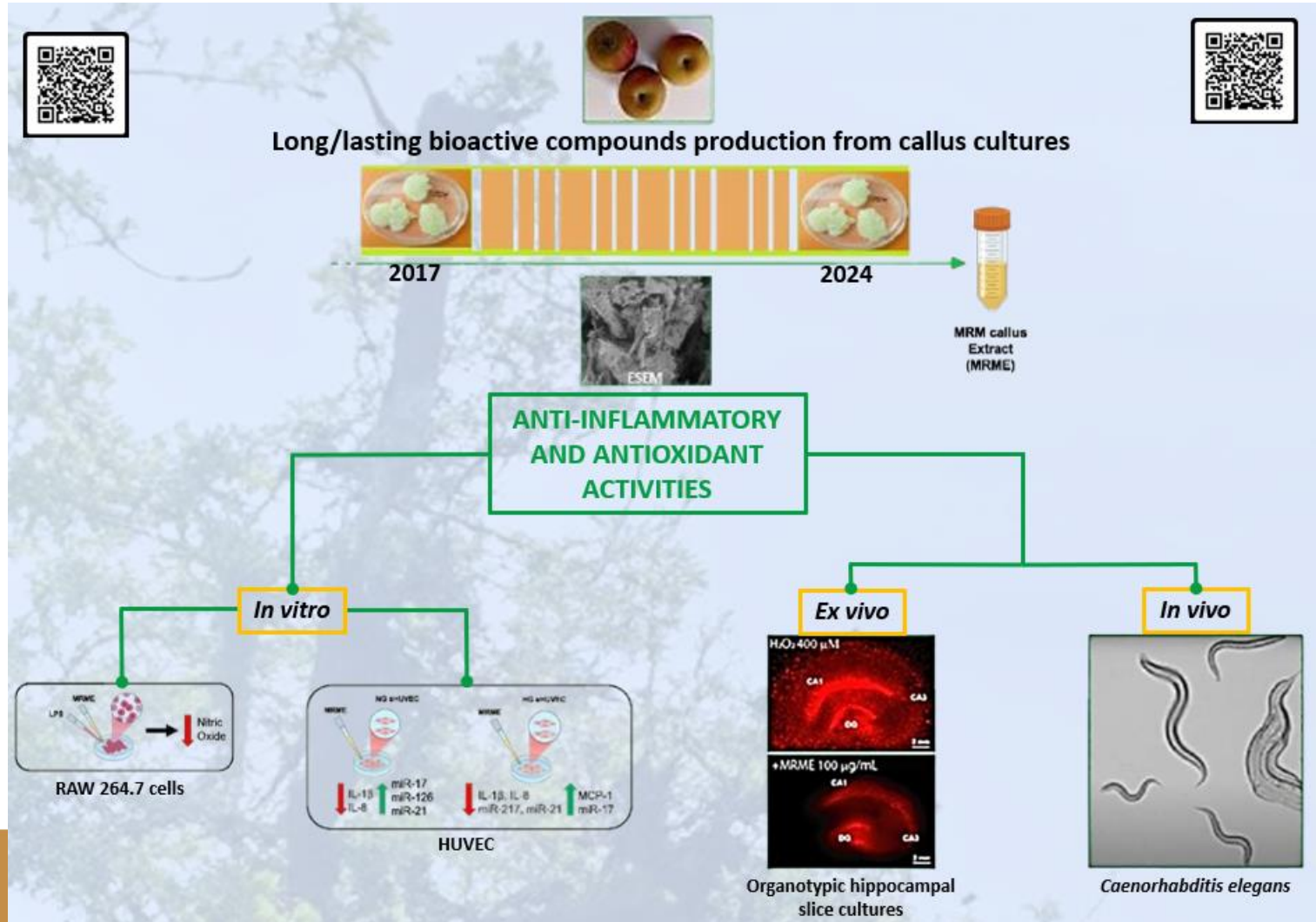

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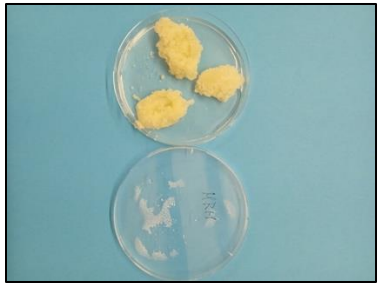
The ripe pulp of the fruit contains meristematic cells that can regain the ability to divide if appropriately stimulated

Mela Rosa Marchigiana

Initial proliferation of meristematic cells from pulp explants



Callus culture

The composition of the phytocomplex remains constant over time
In the fruit pulp, triterpenic acids are present in minimal quantities

Table 1
Triterpenic acids and β-Sitosterol content (μg/100 mg of dried pulp or callus cultures ± standard deviation, and percentage) of MRM pulp and callus cultures after methanolic and ethanolic extraction, quantified by GC-FID.

Compound	Pulp 2017 (100 % MeOH)[a]		Callus 2017 (100 % MeOH)[a]		Callus 2022 (100 % MeOH)[a]		Callus 2022 (70 % EtOH)[a]	
β-Sitosterol	46.74 ± 1.128	96.39	120.90 ± 2.69	2.24	184.41 ± 2.93	5.59	168.63 ± 2.29	5.16
Oleanolic acid	0.10 ± 0.01	0.21	42.10 ± 1.90	0.78	120.44 ± 2.25	3.65	76.05 ± 1.16	2.33
Ursolic acid	0.38 ± 0.01	0.78	174.43 ± 3.58	3.23	334.36 ± 5.42	10.13	321.69 ± 4.10	9.84
Maslinic acid	0.43 ± 0.01	0.89	963.30 ± 17.62	17.82	361.63 ± 4.97	10.96	378.69 ± 5.19	11.58
Corosolic acid	0.41 ± 0.00	0.84	676.77 ± 3.85	12.52	337.13 ± 6.69	10.21	342.56 ± 3.71	10.48
Pomolic acid	0.16 ± 0.00	0.34	17.10 ± 1.47	0.32	79.60 ± 0.08	2.41	39.76 ± 0.60	1.22
Annurcoic acid	0.07 ± 0.00	0.14	504.57 ± 2.59	9.34	587.51 ± 8.32	17.80	595.61 ± 3.50	18.21
Tormentic acid	0.20 ± 0.01	0.41	2905.63 ± 33.51	53.76	1295.56 ± 9.07	39.25	1347.03 ± 10.04	41.19
Total	48.49 ± 1.12		5404.80 ± 46.69		3300.63 ± 6.04		3270.01 ± 21.96	

[a] Extraction solvent.

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WP's activities

Development and formulation of nutraceuticals, functional food and cosmeceutical

task 5.3, 5.4

Characterization of the different prototypes

task 5.2, 5.3, 5.4

Cosmeceutical

Carragenin

Mixture

+

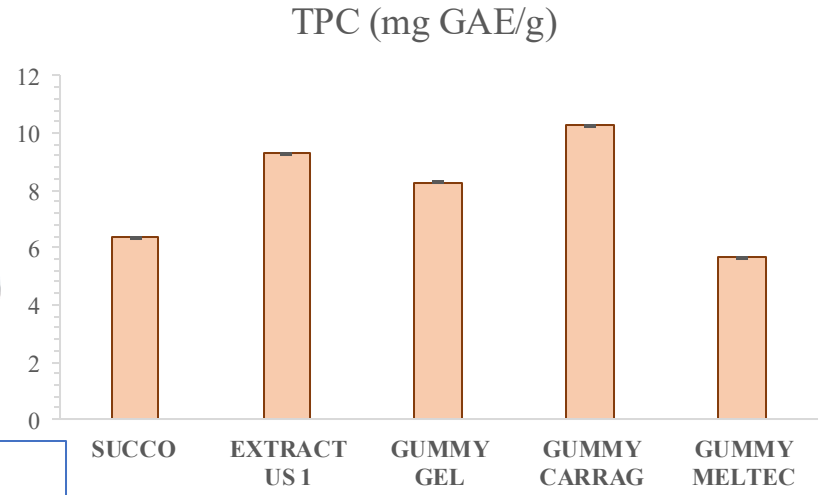
syrup

Nutraceutical

Results

Sample	Hardness Bite 1	Hardness Bite 2	Gumminess	Chewiness (mm)	Cohesiveness [TPA]
Gummy carrag	6,52±0,55	5,78±0,50	3,87±0,42	11,34±1,58	0,52±0,04
Gummy gel	2,48±0,29	1,14±0,29	0,75±0,25	3,14±0,77	0,32±0,14
Gummy Meltec	5,81±0,70	5,29±0,61	3,49±0,62	9,57±1,35	0,56±0,019

Functional Food



less sugar, rich in fiber, rich in bioactive compounds and seaweed gelling agent

Polyphenols at concentration of approximatively 11%

Anthocyanins and flavonols are the major compounds

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WP's activities

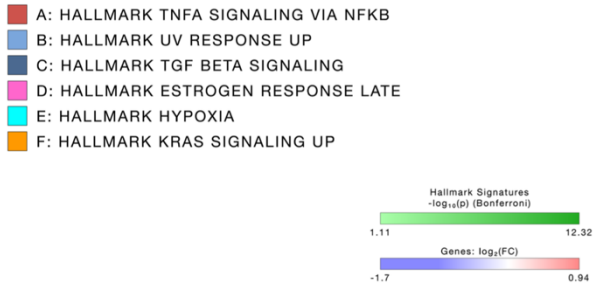
Mela Rosa Marchigiana callus extract (prototype produced by Prof. Fraternale)

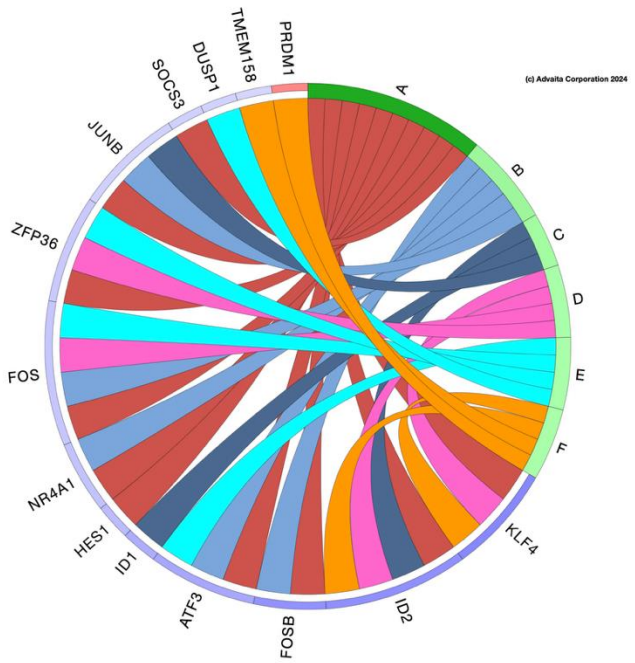
task 5.4

Evaluation of the Nutrigenomic effect of Mela Rosa Marchigiana callus extract on senescent HUVEC cells: trascriptomic analysis and iPathway analysis.

task 5.5

Results





Pathway analysis of differentially expressed genes (DEGs) revealed TNFα signaling as the most significant pathway modulated by the extract in senescent HUVEC cells

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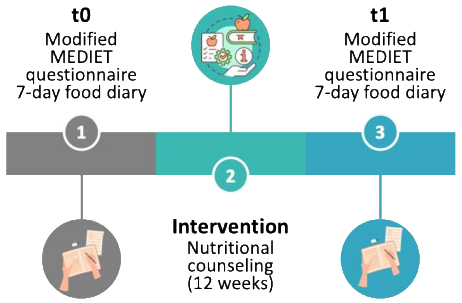
WP's activities

MOVIS project, which focuses on the develoment and application of physical activity and nutritional education programs within breast cancer survivors

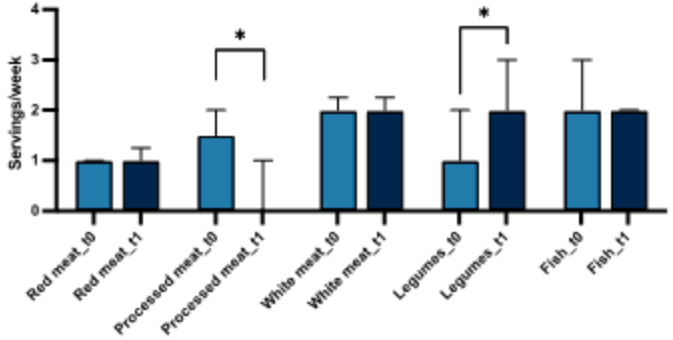
task 5.6

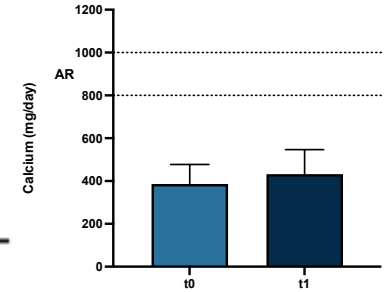
VITHAS project, which focuses on the impact of a predominantly plant-based dietary approach within the university community (employees and students)

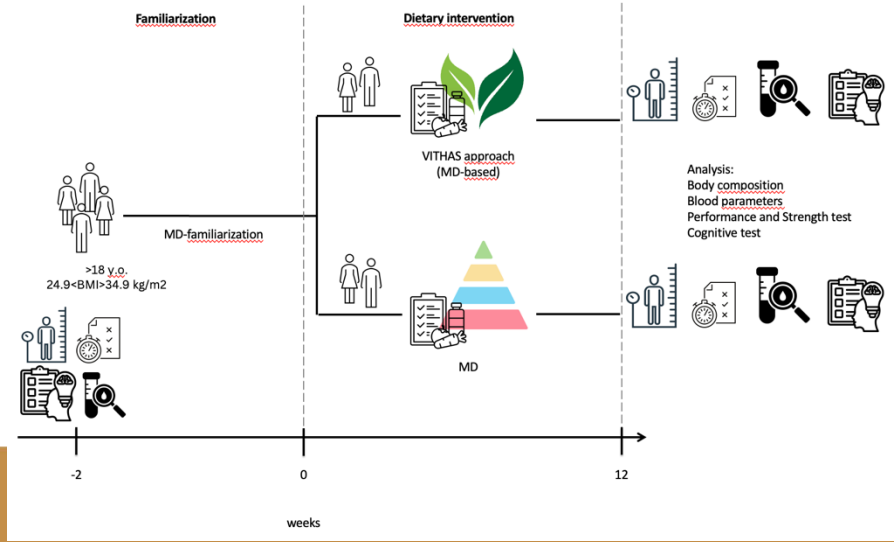
task 5.6



Results







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Special issue

Valorization of typical regional food for the improvement of health and well-being of consumers

Last update 5 June 2024

This Special Issue has been created to share with the scientific community the results that will be obtained by the research program of the National Recovery and Resilience Plan (co-founded by the European Union—Next Generation EU—PNRR MUR project ECS_00000041- VITALITY) related to the valorization of typical regional food (Marche region, Italy) for the improvement of health and well-being of consumers through an innovative nutraceutical and nutrigenomic approach.

This project aims to investigate strategies that can increase the well-being of citizens by making available, in various forms, food-derived bioactive compounds that can counteract chronic inflammation, oxidative stress and maintain healthier conditions. Among the potential products that are rich in bioactive compounds, a particular emphasis is placed on typical central Italy foods of vegetable origin. In this perspective, the most widespread healthy and ancient varieties occurring in the Mediterranean diet habits were chosen. Food chemistry, biochemistry, microbiota, nutrigenomic, functional properties of bioactive compounds, nutraceuticals and personalized strategies for healthy eating are considered.

The University of Camerino and University of Urbino Carlo Bo are involved in this project.

Guest Editors:

Elena Barbieri

Sauro Vittori

22 articles accepted /
63 articles submitted

https://www.sciencedirect.com/special-issue/100K7V7K0N5

- **Work Package5 – Valorization of typical regional food for the improvement of health and well-being of consumers through an innovative nutraceutical and nutrigenomic approach**

Next steps

- ✓ Final selection of probiotic bacteria and prebiotic substrates for testing possible synbiotic combinations (task 5.2)
- ✓ Application of green procedure (DES) on spent coffee waste (task 5.3)
- ✓ Development of fermented functional beverage obtained by grape pomace waste (task 5.4)
- ✓ Assessment of DNA methylation levels in the promoter regions of genes modulated by the extract in young HUVEC, senescent HUVEC and senescent HUVEC treated with the extract (task 5.5)
- ✓ Intervention (12 weeks dietary intervention), evaluation of body composition and blood parameters, strenght and performance test, cognitive test (task 5.6)

Critical Issues (if any)

Within the WP5 we decided to go further with the respect to the project by ***development of cosmeceutical formulation****, which* ***contributes to well-being of individuals***

- **Work Package 5 – Valorisation of typical regional food for the improvement of health and well-being of consumers through an innovative nutraceutical and nutrigenomic approach**

Progetto RESCUE-Bio (companies PIERPAOLI Srl, SYNBIOTEC Srl)

The extracts obtained will be supplied to the companies PIERPAOLI and SYNBIOTEC which will be responsible for:

pierpaoli
DALLA NATURA, PER LA NATURA

Formulation of cosmetic products with cosmeceutical characteristics

-Choice of two extracts: based on the title and range of active ingredients, physical form, microbiological stability, industrial cost,
-Choice of product category: under the guidance of the marketing office, choice of cosmetic categories (face cream, body cream, eye contour, face serum, lip balm, etc.) considering the claims and the possibility of inclusion in solid cosmetics
- Formulation design: carried out by the Pierpaoli R&S lab and with reference to the chosen ecobiological specifications (Cosmos, NaTrue, AIAB, etc.)
- Creation of prototypes: 5 samples for each formula
- Sensory and economic evaluation
- Stability and compatibility tests.
- Dermatological tests, challenge tests and in vivo efficacy
- Regulatory analysis for go to market
- Creation of 500 samples per type

Formulation of functional foods and food supplements also containing probiotics

In collaboration with a confectionery company, Synbiotec will develop a **functional bar** based on a matching between the properties of bioactive compounds, their bioavailability, and the consumer's needs and eating habits..

At the same time, the **nutraceutical formulation in capsules** will be created within the Synbiotec production laboratories.

After the prototypes have been created, an ***in vivo* study** will be conducted on healthy adults to test the products in real-world settings.

-**Prototype** creation

-Identification of suitable **marketplaces** for distribution in web channels.

-Definition of a business model in the functional food system.

-Create a **"future" packaging** that is recognized by the consumer as functional, responsible and with a low environmental impact

Work Package 5 – Valorisation of typical regional food for the improvement of health and well-being of consumers through an innovative nutraceutical and nutrigenomic approach

Progetto RESCUE-Bio (Companies PIERPAOLI Srl, SYNBIOTEC Srl)

Project overview (objectives, expected results)
Contribution to Spoke 6 activities

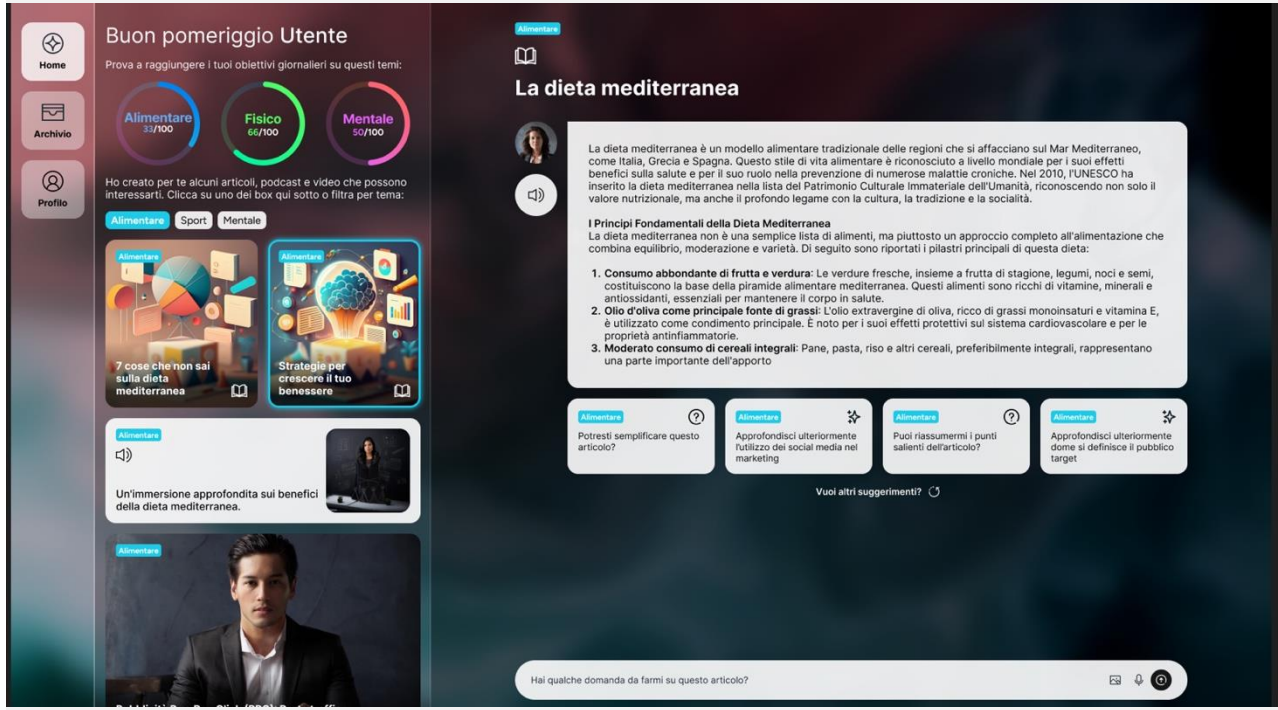
The objectives of this project are:
- creating **new value-added products**
- managing **waste** in line with the objective of sustainability
- improving **human health** through the reformulation of processed foods

The project is at the forefront of sustainable innovation, integrating the **circular economy** into the heart of the **functional food and cosmetics sector**. The revolutionary approach of transforming agri-food waste into valuable resources represents a milestone in the journey towards sustainability and industrial efficiency. The project aims to **revolutionize the way we perceive and use waste, transforming it into high-value ingredients** for the nutraceutical and cosmetics sector. This transformation not only creates **new innovative products** but also brings significant added value, contributing to the diversification an ning of nomy.

Nautes & H.E.A.R.T.

The goal of the H.E.A.R.T. project is the introduction of a digital platform capable of using big data, generative artificial intelligence and behavioural data collected from users to improve the perception and management of individual well-being.

The platform offers an integrated ecosystem for monitoring, analysis and proactive improvement, accessible from various devices via a user-friendly interface.



The H.E.AR.T. ecosystem

MAIN STAKEHOLDERS

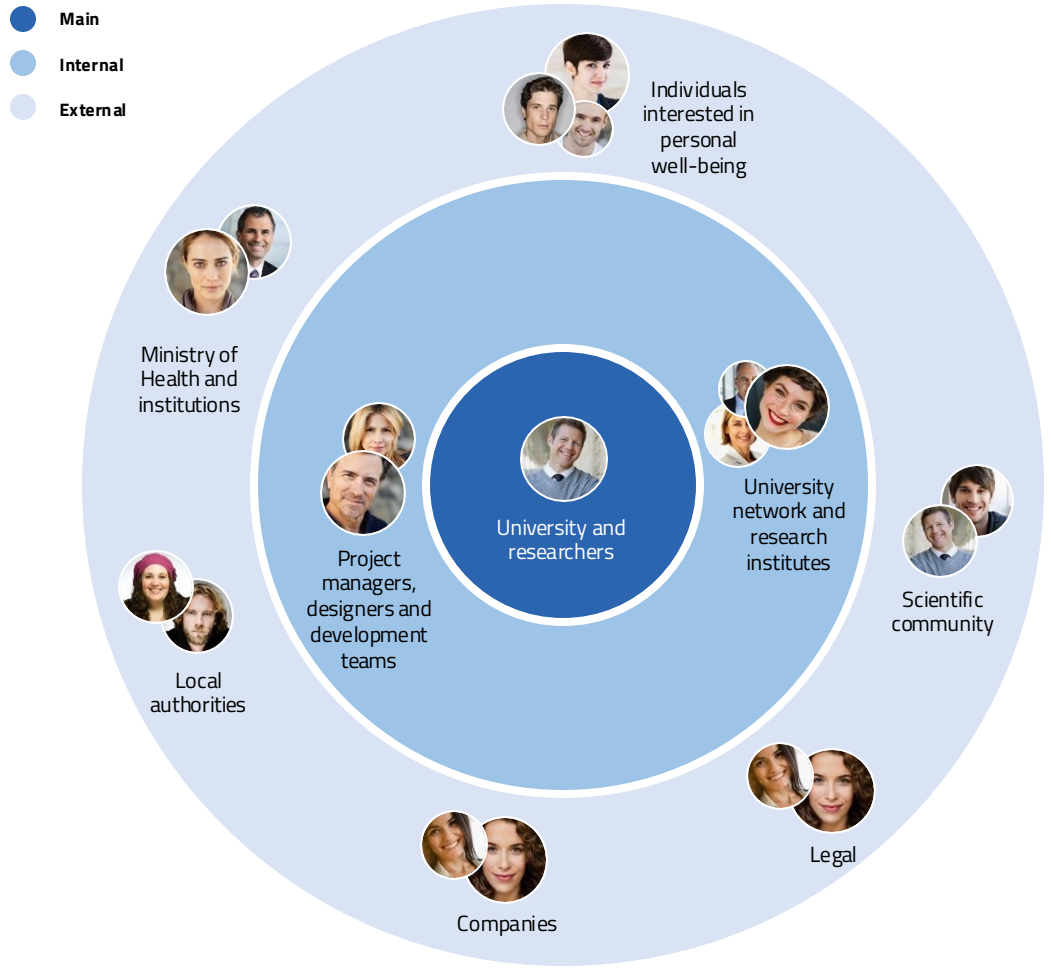
- University and researchers

INTERNAL STAKEHOLDERS

- Project managers, designers and development teams
- University network and research institutes

EXTERNAL STAKEHOLDERS

- Individuals interested in personal well-being
- Local authorities
- Scientific community
- Legal
- Ministry of Health and health institutions
- Companies interested in improving the wellness of their human resources



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Work Package 5

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