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Enhancement of Agro Food Chain Byproducts through Innovative and Sustainable Methods
Project Acronym: eAfoBy

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REPORT – SECOND STUDENTS TRAINING

Universitat Politècnica de València, Valencia, Partner 1 (P1)

29.09.2025-03.10.2025

The second students training was conducted over a five-day period, from **September 29, to October 3, 2025**, in **Valencia, Spain**, at Universitat Politècnica de València, within the framework of the ERASMUS KA project *"Enhancement of Agro Food Chain Byproducts through Innovative and Sustainable Methods"*. The training was entitled Bioavailability and Bioaccessibility of Bioactive Compounds – Aspects of Human Nutrition.
The experts attendance list was as follows:

- Coordinator (CO): Gina Maria Cucuiet, Chiorean Nicoleta Cristina, Alina Rișco,

Szekely Cristian, Balas Petruț Cristian, Maria Florina Roșca.

- P1 (UPV) – Domenech Valiente, Tania; Matas Gil, Adrián; Molina Montero, MCarmen; Rodriguez Barrios, Yeison Fernando; Rus Fernández. Patricia; Vicente Jurado, Diana, Rebeca Lopez Lopez.
- P2 (Universidade do Porto): Diana Isabel Lopes de Melo Ferreira, Liliana Patrícia Ferreira Espírito Santo, Marlene da Conceição Pereira Machado, Matilde Maria Baptista Antão Jorge Rodrigues, Tatiane Cristina Gonçalves de Oliveira, Thiago Freitas Soares
- P3 (Universitatea de Stiintele Vietii „Regele Mihai I" din Timisoara): Argyelan Cristian, Tarkanyi Patricia Cristina, Dragomir Christine, Ghițulescu Andreea, Lăcătăș Mihaela, Neagu Robert-Daniel, Brumar Grațian Ilie.

The first day of the training program was dedicated to establishing the conceptual and methodological foundations of bioaccessibility and bioavailability in human nutrition. The activities commenced with participant registration and a formal welcome session, followed by an introductory lecture outlining the objectives, pedagogical structure, and applied research

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orientation of the workshop. Subsequently, a comprehensive theoretical lecture addressed the fundamental concepts of bioaccessibility and bioavailability, emphasizing physiological relevance, absorption mechanisms, and implications for functional food design. This theoretical framework was complemented by a practical case study comparing polyphenols and carotenoids, allowing participants to critically evaluate differences in chemical structure, matrix interactions, and digestive behavior.

In the afternoon, a specialized workshop introduced standardized **in vitro gastrointestinal digestion models**, particularly the INFOGEST protocol, highlighting their application in simulating oral, gastric, and intestinal phases. The day concluded with collaborative group work focused on the selection of specific bioactive compounds and the design of preliminary strategies to enhance their bioaccessibility, followed by a structured plenary discussion to synthesize learning outcomes.

The second day concentrated on analytical methodologies and quantitative assessment of bioactive compounds. The morning session comprised a lecture and technical demonstration of instrumental techniques commonly employed in food and nutrition research, including high-performance liquid chromatography (HPLC), liquid chromatography–mass spectrometry (LC-MS), and UV–visible spectrophotometry.

This was followed by laboratory practicals in which participants conducted extraction and quantification procedures for selected bioactive compounds, reinforcing methodological rigor and data reliability principles. After the lunch break, a data analysis workshop focused on the interpretation of release and absorption curves obtained from digestion experiments.

The afternoon continued with applied case studies addressing food processing and formulation technologies designed to improve bioaccessibility, such as encapsulation, particle size reduction, and matrix modification. The day concluded with an expert-led discussion evaluating experimental variability, technological feasibility, and translational relevance to the agri-food sector.

The third training day explored intrinsic and extrinsic determinants affecting the bioaccessibility of nutrients and phytochemicals. A theoretical lecture examined matrix effects, physicochemical interactions, and the role of macronutrient composition in modulating bioactive release.Participants then engaged in laboratory experiments comparing the liberation of bioactive compounds from different food matrices, enabling quantitative assessment of structural and compositional influences. The afternoon workshop addressed the impact of food processing

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technologies, including thermal treatments, fermentation, and high-pressure processing, on compound stability and bioaccessibility.

An interdisciplinary role-play exercise followed, simulating the perspectives of food technologists, nutritionists, and regulatory authorities, thereby fostering critical discussion on innovation constraints, safety evaluation, and regulatory compliance. The day concluded with a plenary session summarizing scientific insights and methodological implications.

Day four focused on bridging experimental modeling with human nutrition research. The morning lecture reviewed in vivo and ex vivo approaches, the use of biomarkers, and the design of clinical trials for assessing nutrient absorption and metabolic fate.

A guided analysis of a peer-reviewed scientific publication on flavonoid bioavailability in humans provided participants with practical experience in critical appraisal of experimental design and statistical interpretation. During the afternoon, students participated in an extended workshop aimed at designing a mini human intervention study, covering ethical considerations, subject selection, dietary control, sampling strategies, and outcome indicators. The day concluded with group discussions consolidating protocol designs and preparing structured presentations for the final evaluation phase.

The final day emphasized integration of knowledge and innovation. A creative workshop explored the development of functional foods based on agri-food by-products, with emphasis on sustainability and circular economy principles.

Student groups developed project proposals and product concepts, which were presented in formal academic sessions. Knowledge evaluation was conducted through quizzes and structured feedback. A round-table discussion addressed future research directions in bioavailability studies, followed by the official closing session.