

# Green strategies for a virtuous valorization of by-products of the agri-food chain in the transformation and conservation of foods



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This PhD thesis research project is aimed at developing a circular economy model in the agri-food sector, specifically in the olive oil supply chain, through the production of functional feeds and foods prototypes, enhancing waste and bioactive molecules contained therein, recognizing their health and sustainability value, thus becoming valuable “co-products.”

## 1. State-of-the-Art

In the olive oil industry, olive oil accounts for less than 20% of the final product, the remaining volume consists of by-products, rich in high value-added molecules as phenolic compounds (98% of those occurring in the drupe), with health and technological applicability. Their recovery benefits the environment, the producer, and the consumer [1,2,3].

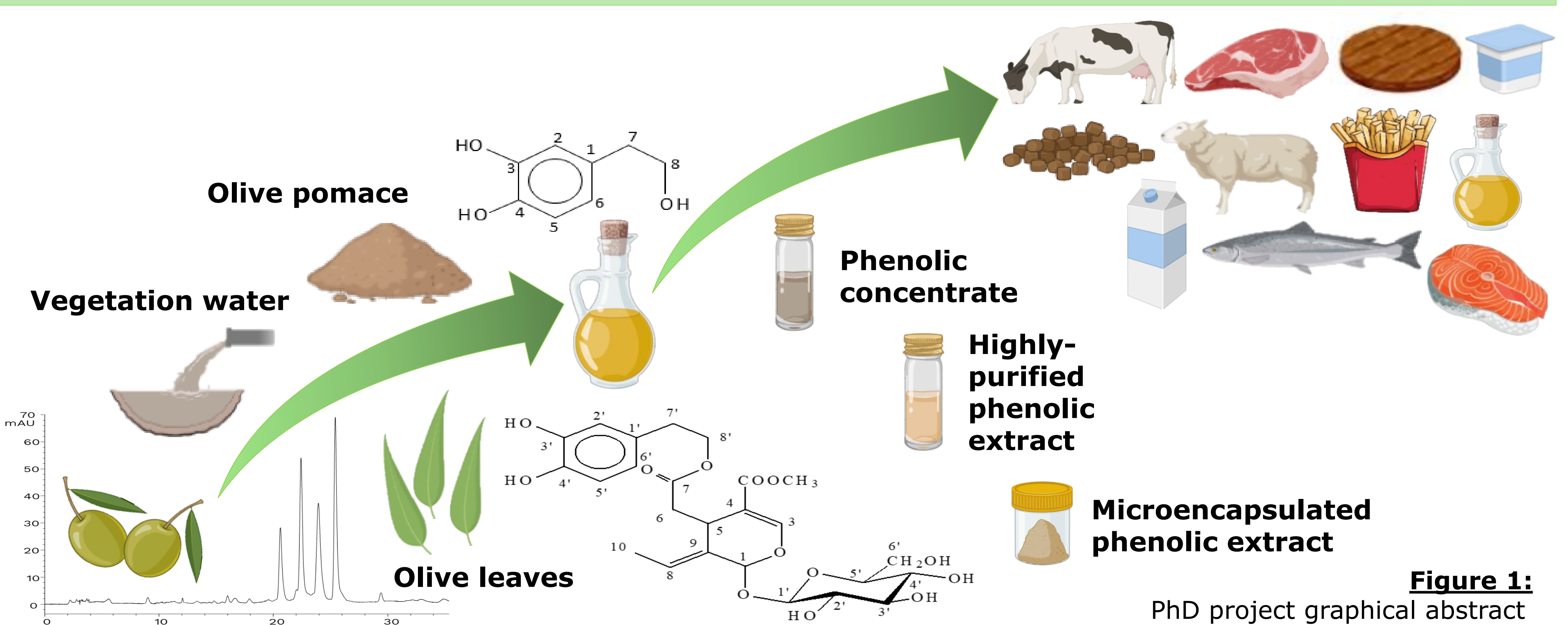


Figure 1:

PhD project graphical abstract

## 2. PhD Thesis Objectives and Milestones

This PhD thesis project (Tab. 1) was subdivided into the following activities:

- A1) By-products treatments**, through green and mild strategies (as ultrasound-assisted extraction and membrane separation techniques) for their recovery and stabilization; preliminary characterization analysis.
- A2) Development and analytical evaluation of prototypes**, such as feeds, functional ingredients, and food additives. Assessment of their biological activities and functional characteristics.
- A3) Application of prototypes** in livestock farming and aquaculture, and in the production of traditional and innovative foods, as functional and/or preservative ingredients.
- A4) Formulations' analysis and optimization**, assessing quality, nutritional, sensory and preservative properties, through real-time shelf-life evaluations.
- A5) Writing and editing** of the PhD thesis, scientific papers, oral and/or poster communications with the aim of disseminating research results.

In addition to chemical-physical characterization, the following analyses will be mainly performed on by-products and prototypes: residual phenols and tocopherol concentration by RP-HPLC-DAD/FLD, volatile compounds by HS-SPME-GC/MS, antioxidant capacity tests (DPPH, ABTS, FRAP). The Design of Experiments (DoE) will be optimized using the response surface MODDE® software (Umetrics-Sartorius), all the results will be subjected to statistical analysis using appropriate methods.

Activity	Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
A1) <b>By-products Treatments</b>																									
1) Recovery and stabilization methods																									
2) Characterization analysis																									
A2) <b>Prototypes Production and Analysis</b>																									
1) Feed																									
2) Additives and functional ingredients																									
A3) <b>Prototypes Application</b>																									
1) In livestock and aquaculture sectors																									
2) In functional food production																									
A4) <b>Analysis and Optimization</b>																									
1) Functional foods and preservatives																									
2) Animal-derived products																									
A5) <b>Thesis and Paper Preparation</b>																									

Table 1:  
Gantt diagram

## 3. Selected References

1. Taticchi A, Servili M, Sordini B, Esposto S, Urbani S, Petruccioli M, ..., Proietti P (2022) *Uso e valorizzazione dei sottoprodotti dell'estrazione meccanica*, In OLEUM (pp. 167-205) Edagricole.
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3. Berbel J, Posadillo A (2018) Review and analysis of alternatives for the valorisation of agro-industrial olive oil by-products. *Sustainability*, **10(1)**, 237.