Sustainability of technology, quality control and consumption of olive oil

PhD Student: Ilaria Grigoletto (ilaria.grigoletto2@unibo.it); **Tutor:** Dr. Enrico Valli

Co-tutors: Prof. Tullia Gallina Toschi, Prof. Massimiliano Petracci

Department of Agricultural and Food Science (DISTAL), *Alma Mater Studiorum* – Università di Bologna, Cesena, Italy

This research focuses on sustainability aspects in relation to technology, quality control and consumption of olive oils. In particular, the development of rapid and sustainable analytical approaches to assess the quality and genuineness of virgin olive oils, that can reduce the use of toxic chemicals and solvents and the energy consumption in the laboratory. Moreover, investigations are in course for the technological valorisation of olive oil by-products (olive pomace) by obtaining sustainable extracts rich in phenolic compounds, potentially usable in other sectors, such as food, pharmaceutical and cosmetic industries. Finally, the study of innovative and sustainable packaging solutions as single-dose packs will be carried out to preserve the quality of the olive oil during the time.

STATE OF THE ART

In the Mediterranean basin olive oil represents one of the main food products, since almost the 90% of the world production comes from this area. In the European Union, virgin olive oils (VOOs) can be classified in three commercial categories depending on their quality: extra virgin (EV), virgin (V) and lampante (L) (Reg. EC n. 2019/1604). The different quality level of each commercial category corresponds to a different value and, subsequently, price. Nowadays, one of the main worldwide challenges is the achievement of the 17 sustainable development goals, known as SDGs (Sustainable Development Goals). Among these, it is important to mention the target 12.3, which focuses on the reduction of food waste and losses along the food production and supply chains by 2030. In addition, Europe is trying to become the first continent with zero impact in 2050, by promoting sustainable activities. In the context of olive oil production and quality control, it is important to consider that most of the official methods to evaluate the quality of VOOs consist of time-consuming and complex procedures, often with the use of toxic chemicals and solvents to be disposed of with dangerous potential for human health and the environment (Valli et al., 2016). For these reasons, there is a growing demand for rapid and environmentally friendly analytical procedures to evaluate the quality and genuineness of VOOs. This could be possible by adopting techniques that do not require solvents, such as the determination of volatile compounds by gas-chromatographic approaches like headspace solid phase microextraction-gas chromatography (HS-SPME-GC), Flash-GC and ion mobility spectrometry (HS-GC-IMS) (Quintanilla-Casas et al., 2020). In addition, olive oil production, as agro-industrial activity, has a strong environmental impact in the Mediterranean area, since it generates up to 30 million tons of waste per year, in which olive pomace is one of the main by-products (Chandra and Sathiavelu, 2009). The major problem related to olive pomace is that it contains organic compounds that could be toxic for the environment. Although olive mill wastes represent an important environmental problem, they still contain high added value molecules, such as phenolic compounds (Dermeche et al., 2013), widely recognised for their beneficial properties. For this reason, their valorisation as functional ingredients in pharmaceutical, cosmetic and food industries (Nunes et al., 2016) represents a sustainable strategy. Finally, in the context of sustainability, it is important to consider the consumption aspect. Nowadays, since products like single-dose packs of virgin olive oils are of increasing interest, following the Directive (EU) 2019/904 on the reduction of the impact of certain plastic products on the environment (European Parliament and the Council, 2019), the study of innovative and sustainable packaging solutions is essential to preserve the quality of the product during the time.

GANTT DIAGRAM OF THE PHD THESIS ACTIVITIES

Activity	Months	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36
A1)	***Bibliographic research***																		
A2)	***Olive pomace valorisation***																		
	Development of sustainable extractions																		
	Characterization and shelf-life study																		
A3)	***Rapid and sustainable analytical methods***																		
	Methods development																		
	Methods application																		
A4)	***Innovative and sustainable packaging solutions***																		
	Evaluation of packaging materials																		
	Shelf-life study																		
A5)	***Thesis and paper preparation***																		

OBJECTIVES

Olive pomace valorisation: development of sustainable methods for the extraction of phenolic compounds, characterization, and shelf-life evaluation of the extracts. This activity is carried out in the frame of the Prima project SUSTAINOLIVE "Novel approaches to promote the SUSTAInability of OLIVE cultivation in the Mediterranean" (Grant Agreement no. 813904), 2019 – 2023.

Rapid and sustainable analytical methods: development and application of innovative, rapid, and sustainable analytical approaches to assess the quality and genuineness of virgin olive oils.

Innovative and sustainable packaging solutions: evaluation of the capacity of different packaging materials as single-dose packs to preserve the olive oil quality during the storage (instrumental and sensory analyses).

SELECTED REFERENCES

Chandra, M. & Sathiavelu, S. (2009). Waste management in the olive oil industry in the Mediterranean region by composting. Clean Technologies and Environmental Policy 11: 293–298.

Dermeche, S., Nadour, M., Larroche, C., Moulti-Mati, F., Michaud, P. (2013). Olive mill wastes: Biochemical characterizations and valorization strategies. Process Biochemistry 48: 1532–1552.

European Commission. Reg. (EU) n. 2019/1604 amending Reg. (EU) n. 2568/91 of 27 September 2019 on the characteristics of olive oil and olive-residue oil and on the relevant methods of analysis. OJ L 250, 30.9.2019, 14–48.

European Parliament and the Council. Directive (EU) n. 2019/904 of 5 June 2019 on the reduction of the impact of certain plastic products on the environment. OJ L 155, 12.6.2019, 1–19.

Nunes, M.A., Pimentel, F.B., Costa, A.S.G., Alves, R.C., Oliveira, M.B.P.P. (2016). Olive by-products for functional and food applications: challenging opportunities to face environmental constraints. Innovative Food Science and Emerging Technologies 35: 139–148.

Quintanilla-Casas, B., Bustamante, J., Guardiola, F., García-González, D.L., Barbieri, S., Bendini, A., Gallina Toschi, T., Vichi, S., Tres, A. (2020). Virgin olive oil volatile fingerprint and chemometrics: Towards an instrumental screening tool to grade the sensory quality. LWT - Food Science and Technology 121: 108936.

Valli, E., Bendini, A., Berardinelli, A., Ragni, L., Riccò, B., Grossi, M., Gallina Toschi, T. (2016). Rapid and innovative instrumental approaches for quality and authenticity of olive oils. European Journal of Lipid Science and Technology 118: 1601–1619.