

Impact Objectives

- Promote excellence in research on Mediterranean agro-ecosystems related to food science
- Develop useful analytical tools to support olive oil certification

Protecting the integrity of food

Dr Maria João Cabrita, from the Food Science Group of the Institute of Mediterranean Agricultural and Environmental Sciences (ICAAM) at the University of Évora, discusses the value of food science research and the importance of the analytical methodologies her team is developing



Why is the topic of food science of so much interest to you?

My scientific work has always been in food science

with a focus on wine research, namely in wine chemistry through the study of the volatile and the phenolic composition of grapes and wines. In close relation to this topic, another research line has developed, which is the chemical composition of woods with oenological interest, such as oak, cherry, acacia and chestnut, and the effect of its application in wines. The analytical methodologies used, namely chromatographic techniques, can also be applied to other food matrices, such as olive oil. We have started a new research line on olive oil. The first project our team was involved in was 'Molecularly Imprinted Polymers solid-phase extraction: A new highly selective and promising approach for trace analysis of pesticide residues in olive oil' and we are now working on the Porço (Portuguese Olive Oil Omics for traceability and authenticity) project.

From your perspective, why is building knowledge about the authenticity of extra virgin olive oils important?

Extra virgin olive oil is not only a commodity product but also a pillar of the Mediterranean diet. Moreover, due to its price and the illiteracy of the consumers, is a product that can be subject to fraudulent practices, not only economical ones but also counterfeits. Evidence suggests that some olive oils can be supplemented with vegetable oil to increase volume to meet market demands, which reduces the purity of the olive oil. The main goal of my latest research project on olive oil, Porço, is to develop useful analytical tools to screen for fraud and to be used for olive oil certification. It is essential to have the ability and capacity to verify the authenticity of extra virgin olive oils for products of Geographical Indication of Origin and Protected Designation of Origin, which are important for marketing, considering geographic and varietal aspect, and evaluating the genuineness of the product, in a context of potentially fraudulent products.

How do you see the Porço study developing in the future?

The analytical methodologies used in this project can be utilised for other food matrices and other food science studies. We also hope that during this project we can encourage the food industry to realise

that some of these methodologies, and the knowledge produced, can be used to their advantage. From the science point of view, I am sure that as we go deeper into this research, new paths will open, new ideas will arise, and hopefully new projects will follow.

In what ways do you think scientists can better engage with the public to demonstrate the socio-economic impact of their work?

It is very important that scientists engage with the public. In my opinion, we have a commitment to the public because the purpose of scientific research is transferring knowledge to society. In the case of our research, and since we are dealing with food safety, the message is easier to deliver. I have found that the best way to achieve engagement with the public is through articles explaining our work, workshops and 'open-days' where people can see what we are doing and better understand the importance of the research work. In this way, scientists can contribute to higher quality and healthier foods and guarantee the integrity of the environment. Indeed, this is the basis of the sustainability, which is a concept that is a growing concern.

Authenticity of olive oil

The Por3o Project is supporting the development of new assessment tools for identifying and authenticating olive oils produced in Portugal

Extra virgin olive oil is a high-quality product and economically important for Portugal. Recently there has been tremendous growth of the olive grove area and a consequential increase in olive oil production in this country. That is why it is so important to focus the research at a country level. We need to know our olive oils and our varieties, if we want to protect them, and to project them into outside Portugal.

Dr Maria João Cabrita, Assistant Professor at the University of Évora and researcher in the Institute of Mediterranean Agricultural and Environmental Sciences (ICAAM), has extensive experience in food science and notes that Portugal is the world's seventh largest producer of olive oil and the fourth largest olive oil exporting country. She says that olive groves are increasing in Portugal so any new knowledge about the Portuguese varieties is extremely important. To support the gathering of new information the Por3o (Portuguese Olive Oil Omics for traceability and authenticity) research project began in late 2016. 'The Alentejo area, where the Por3o research is focused, is responsible for nearly two-thirds of the national olive oil crop', says Cabrita. 'The international trade for olive oil is very complex and tools aimed at authenticity are extremely important'.

COLLABORATIVE EFFORT

This is a national project, involving Portugal's Universidade de Évora and

Universidade Nova de Lisboa. 'It is precisely the national focus that matters to us in this work,' notes Cabrita. From Universidade Nova de Lisboa, Professor Marco Gomes da Silva provides expertise on chromatography and mass spectrometry. From Universidade de Évora Professor Anthony Burke brings expertise in NMR, and Professor Cristina Dias offers expertise in analytical chemistry. 'The team also has young post-doctoral researchers Dr Hélia Cardoso, Dr Tânia Nobre, experts on plant genomics and Dr Raquel Garcia, as well as some master and PhD students,' says Cabrita. The project benefits from some involvement by the INIAV (Instituto Nacional de Investigação Agrária e Veterinária) who provide skills in olive oil sampling.

CUTTING-EDGE TOOLS

A previous research project Cabrita's team was involved in is the development of Molecularly Imprinted Polymers for solid phase extraction for trace analysis of pesticide residues in olive oils, coordinated by Dr^a Raquel Garcia. 'Although my research work has always been focused on wine chemistry, the analytical methodologies used, namely chromatographic techniques can also be applied to other food matrices and so, as olive oil is another important product in the Alentejo region, we started a new research line on olive oil'.

'For the Por3o project we also considered it

critical to gain insights about tools allowing us to verify the varietal origin of olive oils,' she notes. To achieve this, analytical tools were implemented which enabled the researchers to discriminate between olive oils - the olive varieties from which the olive oils were produced. Some of the analytical techniques the team is using in the Por3O Project are cutting-edge. 'This means we can certify an important characteristic, being elementary or varietal olive oils, which are different between single varieties of olives,' says Cabrita. 'This identification could be very helpful in protecting our product, in this case 'Portuguese Olive Oil', as the international trade for olive oil is very complex and tools aiming authenticity are extremely valuable.'



Colégio do Espírito Santo, University of Évora



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In particular, Cabrita notes that the team is using 'genomic and metabolomic approaches for the authenticity of extra virgin olive oils, considering mainly geographic and varietal aspects and differences across Portugal. The genomic approach is based on the olive oil DNA evaluation, as well as the definition of molecular markers for each studied variety. 'The metabolomic approach will utilise a number of techniques. These include profiling and fingerprinting, focusing on the study of the volatile composition of oils using comprehensive multidimensional gas chromatography, as well as the study of mineral elements using ICP-MS techniques. In addition, the study of stable isotopes (SIRMS) and the use of nuclear magnetic resonance spectroscopy to provide a spectral signature of the different oils under study are used.' Cabrita observes that several investigations concerning the 'origin and authenticity of olive oil have shown that chemical analyses *per se* are not sufficient to assure oil authenticity or traceability. A more comprehensive approach is needed and it relies on metabolomics and genomic studies.'

In this kind of study, it is necessary to use a very large number of samples to validate and test the results in order to have recognisable and accurate conclusions. In terms of progress, Cabrita confirms that the team is 'still far away from any conclusion, but we are building our databases, according to the initial proposal'. She also notes that they are 'still in the early stages of this research. As in any metabolomic study, we must gather

information from several samples, at different locations, and over years. We found some trends in the first results, but it is too soon to have reached conclusions.'

DELIVERING REAL-WORLD BENEFITS

'The multiplicity of different data obtained in this study will allow us to establish fingerprinting and profiles, that can be further used for the purpose of olive oils authenticity,' observes Cabrita. 'By achieving a proper and full characterisation of our olive oils, we hope to contribute to a better understanding and knowledge of our varieties. And, of course, statistics are also an important tool, to be able to analyse all the data'.

Apart from increasing valuable knowledge about the Portuguese olive oils, this project is developing, both at a national and regional level, markers that allow analysis of olive oils to address issues such as quality certification, authentication, geographical and varietal traceability. 'Extra virgin olive oils traceability is gaining importance due to high quality demands. If we succeed in our research, the main benefit is for olive oil consumers. People are paying more attention to the food they eat, where it came from, they are more informed, and this is good since informed consumers play an important role in the food industry,' explains Cabrita. The team is excited by the potential for the analytical methodologies used in the Por30 project to be replicated for other food matrices and food science studies throughout the Mediterranean and globally.

Project Insights

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CONTACT

Maria João Cabrita

T: +351 266760869

E: mjbc@uevora.pt

W: www.icaam.uevora.pt

PROJECT COORDINATOR BIO

Maria João Cabrita studied Food Science at the Technical University of Lisbon. Her PhD was obtained at Évora University in 2005. She is Assistant Professor in Crop Science Department (ÉU) at ICAAM. Cabrita is interested in three main research areas: wine chemistry and technology; geographic and varietal origin of olive oils; and molecularly imprinting polymers for pesticide residues in olive oil.

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