



FELLOWSHIP SUMMARY REPORT

Elena Fulladosa
Food researcher
Food Quality and Technology programme
Institut de Recerca i Tecnologia Agroalimentàries (IRTA)

Theme 3: Transformational Technologies and Innovation

Subject Title: Investigation of a spectrometric tool for consumer and food standard agency use on site

Host institution: University of Strathclyde, Pure and applied chemistry, Glasgow (UK)

Host collaborator: Prof. Alison Nordon

Dates of Fellowship: 27th June 2022 through 21st August 2022

I consent to my report being posted on the Co-operative Research Programme's website



1. What were the objectives of the research project? Why is the research project important?

Food safety, fraud prevention and implementation of sustainable healthy diets are major challenges for all European governments. Development of tools for consumers and food standard agency use may help to achieve these challenges. Non-invasive technologies based on infrared through digital devices can determine food composition and quality, but they require specific calibrations, technical knowledge and are too expensive for consumers.

This research intends to provide a tool that could in the mid-long term enable personalized nutrition and adoption of more sustainable healthy diets, boost consumers’ confidence in food origin and quality by increasing transparency and prevent food fraud and increase sustainability and food waste reduction.

The **aim of this CRP fellowship research project** is to make a step forward to the design/development of a bespoke spectrometric system for on-site use (for consumers and food control agencies), considering different sensors and data processing requirements to determine food composition and quality parameters. To achieve the main objective of the project, the following **specific objectives** will be pursued:

1. To investigate the effect of two packaging materials on the determination of composition (specifically salt and water content) on an example food (meat) when using different sensors with different characteristics.
2. To explore different spectral pre-processing and multivariate analysis methods to overcome the problems encountered when measuring on-site, specifically to remove the effects of plastic and temperature variation.

Other non-scientific relevant objectives are to strengthen collaboration between IRTA and the University of Strathclyde and CPACT (meet people and increase knowledge of the capabilities of both parts) as well as the preparation of future collaborations (exchange of predoctoral students, participation in national projects activities, etc).

2. Were the objectives of the fellowship achieved?

The global objective of the Project “To make a step forward to the design/development of a bespoke spectrometric system for on-site use (for consumers and food control agencies), considering different sensors and data processing requirements to determine food composition and quality parameters” has been successfully achieved. The work developed during the research stage has helped to increase knowledge on different sensors and data analysis that will help with the development of this device and to continue the actual research line started at IRTA. In addition, I had valuable discussions and meetings with members of Nordon’s research group that will help with the development of a bespoke spectrometric system for consumers. Next, the degree of achievement and deviation of the specific objectives is reported:

Objectives	Deviations
1. To investigate the effect of two packaging materials on the determination of composition (specifically fat content) on a food model (meat) when using three different sensors with different characteristics.	Effect of packaging materials has been studied using the two sensors, which could be utilised by consumers in a supermarket environment. Determination of salt and water content in an example food have been evaluated instead of fat content. Effect of temperature on the determination of salt has also been studied in depth. <u>Achievement:</u> 90%. Studies will be finished and published in the next months.



<p>2. To explore different spectral pre-processing and multivariate analysis methods to overcome the problems encountered when measuring on-site, specifically to remove the effects of plastic and temperature variation.</p>	<p>Different strategies to overcome the effect of plastics and temperature variation have been evaluated. <u>Achievement:</u> 90%. Studies will be finished and published in the next months.</p>
<p>3. Other non-scientific relevant objectives are to strengthen collaboration between IRTA and the University of Strathclyde and CPACT (meet people and increase knowledge of the capabilities of both parts) as well as the preparation of future collaborations (exchange of predoctoral students, participation in national projects activities, etc).</p>	<p>New collaborations specifically i) on the supervision of Master's thesis, ii) exchange of predoctoral students, and iii) participation on Research projects have been established. <u>Achievement:</u> 100%.</p>

3. What were the major achievements of the fellowship? (up to three)

Scientific and societal achievements: The best strategies to develop robust predictive models to determine foods nutritional composition and quality using spectrometric sensors in situ/at supermarket level have been identified. This will represent an important advance on the development of this spectrometric system. Besides, the results obtained are expected to be publishable in high impact international journals and presented at prestigious international conferences in the coming months. The results have substantially enhanced the knowledge of data analysis and the behaviour of spectrometric devices for implementation in a supermarket or used on site by food standard agencies. Therefore, this will help to address European challenges on food safety, nutrition, and sustainability since we will overcome existing constraints on the measurement of parameters of interest.

Opening of new horizons: The visits to different laboratories allowed me to familiarize myself with different spectrometric equipment used by the different research teams as well as the analysis of data obtained during the studies. The experience gained will be applied in next experiments. New collaborations might start from here.

Increase of international network: This research stage has strengthened the relationship between IRTA and the University of Strathclyde and CPACT, thanks to the visits to different centres and the meetings with different researchers. During the meetings many of the researchers showed interest in promoting future collaborations. For the moment, we have started a new collaboration of Alison Nordon and Findlay Clark (PhD student) to a recently approved national project. Exchange of PhD students and common supervision of master's projects is also planned.

4. Will there be any follow-up work?

Is a publication envisaged? Will this be in a journal or a publication? When will it appear?

Our aim is to publish a JCR paper related to the use of different strategies to overcome the effect of temperature and plastics when using low-cost spectrometric sensors by consumers. We hope to submit the paper in 2022 or beginning of 2023.

Is your fellowship likely to be the start of collaboration between your home institution and your host? We started our collaboration in 2021 by collaborating on the dissemination of different spectrometric topics on food through CPACT. Now, the collaboration has been reinforced and some activities have been planned for the next years.

Is your research likely to result in protected intellectual property, novel products, or processes For the moment, it is not foreseen.



5. How might the results of your research project be important for helping develop regional, national or international agro-food, fisheries or forestry policies and, or practices, or be beneficial for society?

The present research stage has substantially enhanced our knowledge on the behaviour of a device when implemented at a supermarket level or used in situ by food standard agencies. This tool is expected to provide long-term important benefits for the well-being of EU population and food systems sustainability. This will help to address European challenges on food safety, nutrition, and sustainability since we will overcome existing constraints on the measurement of parameters of interest. In terms of Policy relevance, this research will also be a step forward to the increase of transparency and to the control of fraudulent practices as well as to the establishment of policies to boost sustainable healthy diets.

6. How was this research relevant to the objectives of the CRP? And the CRP research theme?

This research proposal aligns with food nutrition and sustainability challenges from CRP, mainly focusing on pillar III but also pillar II. It aligns to pillar III (Transformational technologies and innovation) because the research is aligned with the development of new digital technologies specially intended for consumers. It also boosts digitalization at the consumer level to provide information that can transform habits and boost adoption of more sustainable practices as well as adoption of healthier diets. It also aligns to pillar II (Strengthening resilience in the face of multiple risk in a connected world) specifically on 'Food safety topic' because the final purpose is to provide a tool that can increase transparency and prevent food fraud and safety.

The proposed Project is also aligned with *Farm to Fork strategy* from European Union, and with the *Sustainable healthy diets guiding principles* from World Health Organization.

7. Satisfaction

Did your fellowship conform to your expectations?

Yes, absolutely. The members of my host lab were very welcoming, and I had many useful discussions with them while I was there. Members of Professor Nordon's group have worked extensively on related methods and gave me valuable guidance on adapting those approaches to my application.

Will the OECD Co-operative Research Programme fellowship increase directly or indirectly your career opportunities? Please specify.

The fellowship has increased directly and indirectly my career opportunities. The benefits are linked to the development of new and stronger collaborations with the University of Strathclyde what will enhance the internationalisation of my research. The complementarity of our research agendas is clear, and I see opportunities for future joint research efforts on National and European projects, increasing financial opportunities. It will also impact on the exchange and mobility of predoctoral students. Besides, Spanish and Catalan 'Quality accreditation and quality evaluation agencies' and also IRTA considers as a merit for future promotions the research stages in recognized foreign research institutions and the publication of high JCR quality papers with foreign researchers.

Did you encounter any practical problems?

I did not encounter any problems with the OECD fellowship grant.

Please suggest any improvements in the Fellowship Programme.

I found the OECD fellowship programme optimal. However, I think that supporting travel and subsistence costs of family members would help to foster gender balance in research.

8. Advertising the Co-operative Research Programme

How did you learn about the Co-operative Research Programme?



I learned about the OECD co-operative research programme through an e-mail that was sent out by IRTA applications office.

What would you suggest to make it more “visible”?

No suggestions. I think it is easy to find.

Are there any issues you would like to record?

For me, it has been a great professional and personal experience.

I wish to thank OECD and particularly to Mr. Rafael Blasco for his availability and guidance during the preparation of the application, and to Mrs. Nathalie Elisseou for the efficient administration of the documentation and payments.