MoniQA Conference: **Food Fraud Prevention and Effective Food Allergen Management**

Bari, Italy 26 - 27 January, 2017

Notes of meeting

This was a two part meeting with day one on food fraud and day two on food allergen management.

Food Fraud

In the opening lecture of the conference ***Michael Walker*** in a talk ***'Food detectives: what it takes to trace food fraud'*** described the historical cycle of meat species fraud and as an expert member of Professor Chris Elliott's UK review, the spectrum from 'cutting corners' to food crime. Michael summarised the Elliott Review findings – the '8 pillars of food integrity', dealing particularly with the National Food crime Unit, NFCU, the Virtual Authenticity Network and intelligence sharing. Michael concluded with case studies based on referee cases and conclusions. These included advice on curation of datasets, intelligence sharing and adequate levels of analytical surveillance for food fraud.

Cesare Varallo, a food lawyer and regulatory specialist, gave a persuasive talk on how food companies should handle a food recall – starting with planning for what you hope will never happen. Decide (in advance) who will do what if a recall needs to happen and have an effective communication strategy. Consumer safety, avoidance of panic, and brand protection can be achieved, Cesare noted especially not to neglect social media.

Jeff Moore, Director, Science-Food Standards, United States Pharmacopeia, USP, explained the background to USP's involvement in food. Jeff explained the USP's current (free to download and comment on) validation of Non-Targeted Methods for Food Fraud Detection. Non-targeted methods work by, instead of looking for what should *not* be there but by defining carefully what *should* be there. Any deviation in the expected analytical signal flags up suspicions that can be further investigated. This is a powerful approach to check for the 'unknown unknowns' but so far has been difficult to validate to accepted chemistry standards so this USP advice is very welcome. The USP food fraud mitigation strategy and food fraud database are key resources. It's impossible for every food firm to investigate every ingredient – USP guidance shows how to funnel down risky ingredients so as to prioritise vulnerability assessments. The Food Fraud Database can give real time information on designated ingredients and record types of food fraud, incidence records, inference records, surveillance records, and methods. Find out more at http://www.usp.org/food

Jingyi Li Blank, Director, Mintz Group, Hong Kong gave a fascinating glimpse into the highly restricted world of private investigations in food. Her examples included background checks on people, information related to acquisitions, disputes, IP violation, post-fraud internal investigations, and corruption and bribery investigations. All these are handled in a highly restricted and confidential manner. The information is derived by wholly legal means from public records, (which can be broad, e.g. personal attendance at court hearings), and human intelligence inquiries. For example, in China, understanding the true ownership and management structure, the local government dynamics, or whether the company or its principals have ever been subject to

corruption or litigation issues, have been key to helping clients understand the profile of an important partner.

Alain Maquet, of the Joint Research Centre (JRC), European Commission gave an overview of targeted single/multiple marker approaches (IRMS) and fingerprint type of methods,(-omics and IR). Alain showed organic wheat can be differentiated from conventionally grown wheat by transcriptomics although more samples will be needed to enhance the predictive ability of the technique. Untargeted metabolomics were successful in classifying organic v's conventionally grown carrots.

Marco Arlorio, Università del Piemonte Orientale "A. Avogadro", Italy, made the point in a talk on post-analysis data processing of untargeted methods that untargeted = big data – so what post analytical steps need taken? His solutions included data fusion by mathematical algorithms better to describe the phenomenon, along with 'deep analytics', and artificial intelligence – artificial neural networks, although these must be trained by large numbers of samples. Once again the problems of lack of reference standards raised its head.

Bert Popping formerly Eurofins, now teamed with Carmen Diaz-Amigo in their own consultancy firm compared the food frauds uncovered by Fredrick Accum ('*Death in the pot*') 200 years ago with modern frauds, many in the same product categories such as olive oil. He emphasised considerations of mass balance in detecting fraud and looked at the information to be derived from consumer product buying patterns and, without using the term, discussed 'the consumer as analyst' affirming the findings of our own horizon scanning in this regard.

Richard Cantrill, Chief Science Officer, American Oil Chemists' Society (AOCS), gave a good generic answer to the question 'What is your favourite olive oil? - "one I can taste before I buy". If you can't rely on that, exacting olive oil specifications have been developed together with elaborate analytical approaches. The International Olive Council has devised approaches to verify authenticity by relying on multiple approaches to oil chemistry designed to limit the possibilities of adulteration with other common seed oils.

Professor Tullia Gallina Toschi, University of Bologna, Coordinator of the OLEUM Project descried its aims to better guarantee olive oil quality and authenticity by empowering the detection and fostering the prevention of olive oil fraud. Over four years, the project will develop, with the widest range of stakeholders, new methods and carefully revise existing analytical methods for detection of frauds in different categories of olive oil. It will establish a wide community of laboratories and institutions involved in quality control (OLEUM Network) and by storing and sharing relevant data and results (OLEUM Databank). OLEUM has identified gaps – in legislation and regulatory, analytical approaches, harmonisation and coordination, and consumer and market confidence – and wants to address these and enhance competitiveness of European olive oil sector. But there are many global control labs using all the existing methods so it is best to adapt what we have and improve it to make existing methods more effective and efficient. OLEUM is still in its first few months.

Michal Godula, Thermo Fisher, Italy, described resolving food authenticity challenges using advanced isotopic ratio analysis using Orbitrap high resolution mass spectrometry.

David Psomiadis, Imprint Analytics, Austria, described developments in food authenticity testing by stable isotope analysis, a service provided by Imprint Analytics.

Valeria Terzi, Genomics Research Centre, CREA-GPG, Fiorenzuola d'Arda, Italy, discussed DNA markers, digital PCR and NGS to secure authenticity (e.g. Durum wheat) and safety (e.g. mycotoxins) in the small grain cereals sector.

Kezban Candogan, Department of Food Engineering, Ankara University, Turkey, spoke on the species identification of raw meat mixtures Using Fourier Transform Infrared Spectroscopy.

Food Allergen Management

Professor Clare Mills, University of Manchester, Coordinator of the iFAAM Project, UK opened the second day of the MoniQA International Symposium in Bari. In Clare's wide ranging review of the development of risk assessment in food allergy the highlight for me was the new data generated in iFAAM broadening the evidence base to support threshold doses and evidence-based action levels for allergens in foods. This has the potential to yield a risk assessment. Secondly Clare re-emphasised the need for better analytical methods and reference materials for food allergens.

Professor Samuel Godefroy, (Laval University, Canada, and Queen's University Belfast) spoke on risk assessment and the regulatory perspective, echoing calls for better analysis. Prof. Godefroy welcomed application of deterministic risk assessments for incident evaluation but also the moves within iFAAM towards a more probabilistic risk assessment which will be of wider application in better management (and reduction of) precautionary allergen labelling. But he cautioned that harmonised international guidance is needed to make a level playing field for regulators and a more predictable environment for industry.

Professor Luigi Macchia, University of Bari, gave a fascinating talk on the local clinical food allergy prevalence in the Puglia region.

Prof Clare Mills presented data from ***Dr Audrey DunnGalvin*** of Cork on the iFAAM labelling survey to help us to understand more about how those living with food allergy assess risk when making decisions based on precautionary allergen ("may contain") labelling. These data will be key in creating conditions in which food labelling is truly useful for, and more importantly, *used by* consumers with food allergies.

Luca Bucchini, Hylobates, Italy, gave a detailed analysis of the iFAAM database of food allergen recalls, calling for more harmonisation of how regulators deal with and report recalls.

Robin Sherlock, DTS FACTA, Australia, walked us through the Allergen Bureau VITAL 2.0, showing how industry benefits from food allergen management support tools. Robin, who was an Allergen Bureau Board member from the start of this excellent programme noted that analysis plays only a small part of the spectrum of Allergen Bureau allergen management and risk assessment tools. But the benefits of good analysis include monitoring incoming ingredients, investigating, validating and verifying cleaning and problem solving and troubleshooting, especially with any problematic equipment on the manufacturing line.

Daniel Imhof, Head Official Food Control Authority Brunnen, Switzerland explained how Switzerland set a value of 1 g/kg (0.1 %) which triggers allergen labelling, even if the allergen is not intentionally added but has inadvertently entered the finished product. The legislation has not set a limit, but a 'mark' by which the food industry should be aware of unintentional contamination in the context of

their own product control and allergen management. In 2006 Allergie Suisse SA also defined a maximum value (50 mg/kg) for allergens, as an analytical detection limit and assess and publish complying products. Of the approximately 400 certified products so far, this value was not been exceeded. Hence the 1 g/kg (0.1 %), set up 20 years ago, is in effect superseded since the food industry seems to be operating at in-house limits much below this and below the 50 mg/kg Allergie Suisse limit.

My own talk, immediately after lunch seemed to go down well, and I hope my recommendations on how to report allergen results are well received and put into practice. The take away message was:
Reporting the results of allergen analysis; A report should state:

- Method of analysis
- Result: *[X] mg/kg as Y*,
  - where [X] is the best estimate of the concentration of allergen found by analysis of the sample received after in-laboratory homogenisation, extraction and analysis by a validated method, and
  - Y is EITHER the allergen protein OR the name of the food.
- **But if the whole food is the reporting basis the conversion factor from allergen protein to whole food must be given**.
- Conversion factors should be agreed with literature references to the typical protein contents of (at least) Annex II allergens. Adding the N to protein factor would be useful.
- *As a matter of routine the basis of data as allergen or (preferably) allergen protein should be specified every time a datum is given in a method or report. ….. Until it appears to be ad nauseam*

Walker M & Rogers A, Romer Academy 2016
I also put in a slide asking for expressions of interest about a Marie Curie fellowship at LGC on allergen protein measurement by exact matching IDMS.

Prof. Melanie Downs, - Food Allergy Research & Resource Program, FARRP University of Nebraska-Lincoln, walked us through the FARRP development and validation of effective food allergen control plans.

Dr Linda Monaci, ISPA-CNR, Italy, gave a comprehensive and technically thorough review of the current literature and advances made in methods for food allergen analysis. Linda especially focused on tandem MS methods capable of detecting multiple allergens at the same time within a single run.

Ronald Niemeijer, R-Biopharm, Germany reviewed rapid methods in food allergen management.

Dr. Roland Poms, Secretary General/CEO, MoniQA discussed food allergen reference materials and their impact on more reliable analytical results. MoniQA has liaised with the EU funded project iFAAM, the Prolamin Working Group and Australia's Vital concept group. The first validated Reference Materials for Food Allergen Analysis were presented at the latest AOAC Annual Meeting 2016 in Dallas, Texas, USA. The first set of materials includes testing materials for milk allergen analysis comprising a Positive Control (SMP-MQA 092014, characterized dried skim milk powder), Negative Control (BLANK-MQA 082015, based on a gluten free cookie), and two Incurred Materials: LOW-MQA 092016 (SMP incurred in gluten free cookies, milled, concentration approx. 5 ppm) and HIGH-MQA 082016 (SMP incurred in gluten free cookies, milled, concentration approx. 50 ppm). A new gluten material is in preparation which is based on an extensively characterized wheat flour able to be employed for protein, peptide, DNA, and potentially other markers to be analysed. The reference material for gluten-free analysis will be available as incurred materials at concentrations of 0, 5, 10 and 100 mg/kg gluten in a baked product. Other food allergen reference materials (egg and soy) are in preparation.

Dr Katharina Scherf, German Research Centre for Food Chemistry, Leibniz Institute, Germany gave an overview of methods for gluten analysis, including the benefits of current methods and remaining challenges for this very complex analyte. There is as yet no certified reference material for gluten, although there is the Prolamine Working Group material. Differing ELISA platforms can yield differing results probably owing to variable prolamin/glutelin ratios. A GP-LC-FLD was developed that appeared to perform well and a stable isotope dilution method was used to quantify the immunodominant 33-mer gluten peptide.

The talk by ***Dr Maria De Angelis***, University of Bari, Italy, on meeting the needs of celiac and gluten-sensitive consumers was delivered by ***Dr Fabio Minervini***. Sourdough fermentation, a traditional biotechnology for making leavened baked goods, was recently rediscovered by the scientific community, consumers and producers. In sourdough bread acidification, proteolysis, activation of endogenous enzymes and fermentation takes place. Based on this De Angelis' research group work included fungal proteases and selected lactic acid bacteria in a strategy for spray dried wheat subject to sourdough fermentation could meet the needs of celiac and gluten-sensitive consumers. It could also improve the intestinal microbiota and host immunity increasing the resilience to CD.

Lastly ***Kathryn Miller***, Coeliac UK, talked us through the crossed grain symbol and the certification of gluten free products.