

MoniQA's contribution towards a global harmonisation of foodstuff quality and safety assessment and monitoring strategies

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1. Introduction

With the demand for good and healthy food, its availability in sufficient quantities and year round, conveniently packaged and sold in supermarkets, with an acceptably long shelf-life, and appealing taste and appearance, more and more foods and food products are being traded around the world. Globalisation and consumer demands require new processing and distribution strategies, which bear new risks and challenges for the safety of foods and feeds. Climate change and natural disasters add to the challenges to provide safe and sufficient foods.

Ensuring that these foods are of high quality and safe to eat when they reach the consumer requires reliable food analysis techniques. Recent food hazards such as BSE, *Salmonella* and *Escherichia coli* outbreaks, *Listeria monocytogenes*, acrylamide, avian influenza, Sudan red, melamine, ochratoxin, and others have emphasized the importance of protective legislation and powerful analytical test systems to ensure safety of foods.

In recent decades, safety and economical concerns have been the main driving forces for the development of rapid methods as well as the birth of a multitude of companies providing these technologies to industry and government. The need for rapid intervention for managing product tampering, bio-terrorism, and food contamination outbreaks have also led to the development of faster methods. Rapid tests help industries in determining the effectiveness of food safety measures (e.g. in hazard analysis of critical control points; HACCP), legal compliance as well as achieving logistical and operational goals while saving time and investments in complex instruments and staff qualifications. In some cases they also reduce costs. Other drivers for the development of rapid methods in manufacturing have been the small sample size and quantities, portability of test systems, national and international regulations, and the potential universal use.

There is always, however, for the user the required aspect of proving that the method works, that it is fit for purpose,

gives indeed equivalent results to the reference method and can be used with confidence in the user's laboratory. In addition rapid test methods are often like a black box to the operator, who does not need to be highly qualified and who often lacks understanding of the underlying concept of the test method and its associated pitfalls.

Standardized methods of analysis are highly valued by all stakeholders involved in food safety and quality, trade and retail. National legislation as well as international agreements refer to documentary standards (product as well as procedural standards) to enable international trade as well as to support the well-being of consumers. Many of the standardized methods available nowadays have been validated by a collaborative study organized and evaluated according to internationally agreed protocols. Although a collaboratively validated method is considered as having an impeccable pedigree with regard to transferability among laboratories, a laboratory still needs to demonstrate that it is able to competently apply it (as required by ISO/IEC 17025:2005, i.e. clause 5.4.2: 'The laboratory shall confirm that it can properly operate standard methods before introducing the tests or calibrations').

The aim of the EU funded MoniQA Network of Excellence (MoniQA NoE, FOOD-CT-2006-36337, Monitoring and Quality Assurance in the total food supply chain, 2007-2012, www.moniqa.org) was to make the food chain safer by contributing to the development and validation of reliable test methods and by harmonising safety and quality testing schemes on a global basis.

2. Strategy

The strategy of MoniQA to contribute towards a global harmonisation of foodstuff quality and safety assessment and monitoring strategies was based on a multi-disciplinary and international approach through involving a global network and considering issues of global importance, though prioritized and managed by selected working groups, and by elaborating tools and harmonized approaches ready-to-be used by the concerned stakeholders (laboratories, food

businesses, authorities, policy makers, method providers and developers). Right from the start of MoniQA in 2007 we have been aware that harmonization and generating agreed standards would take time and the manifold areas of food safety would need selection of a few priority areas. Our main concern was to find broad agreement and acceptance of the proposed protocols, guidelines, and other tools needed for harmonization of monitoring and control strategies. MoniQA has fully achieved its goal to contribute to international standardization and establishing a sustainable network to continue the harmonization efforts within the frame of MoniQA Association (i.e. the International Association for Monitoring and Quality Assurance in the Food Supply Chain established in 2011).

3. Contributions

The main contributions of MoniQA to harmonization of food safety and quality assessment strategies and standards are mentioned below.

A trusted partner in collaborations with Codex Alimentarius and international standardisation organisations

MoniQA provided a direct link to stakeholders and experts around the globe and has become a trusted partner for advice, consultancy, protocol and standards development, conducting validation studies, producing reference materials and providing training. Direct support was given to the Codex Committee on Methods of Analysis and Sampling, the International Organization for Standardization (ISO), the European Committee for Standardisation (CEN), the Association of Analytical Communities (AOAC), the International Union of Pure and Applied Chemistry (IUPAC), a.o. Earning the trust and the collaboration of standardisation organizations paved the way to agreement and broad acceptance of any documents, recommendations and tools that were provided by MoniQA.

Protocols and guidelines for method validation

In various MoniQA working groups and in collaboration with other international organizations, MoniQA developed the following internationally agreed protocols and guidelines: (a) joint AOAC-MoniQA guideline for validation of quantitative milk allergen ELISAs; (b) joint IUPAC-MoniQA protocol for validation of qualitative methods for food analysis; (c) contribution to the ISO-Workshop Agreement on bulk sampling; (d) contributing to ISO and CEN standards in working groups of CEN TC 275 'Food analysis - Horizontal methods' (WG0 'General Considerations', WG3 'Pesticides and PCB's in foods of animal origin', WG4 'Pesticides in foods of plant origin', WG5 'Biotoxins', WG12 'Food allergens', and WG13 'Process contaminants'); (e) guidance document on the issues concerned in validating tandem mass-spectroscopy (LC-

MS-MS) used for analysis of chemical contaminants; and (f) guidance document for use of LC-MS-MS for food allergen analysis. Agreed protocols and guidelines for validation of methods is the first prerequisite for harmonization of performance criteria and standards of analytical methods to assure reliability and comparability of results. It was not MoniQA's intention to harmonise methods, which would be contra-productive considering new developments and innovation, different environments and budgets. However, results need to be trusted on both sides of the value chain, i.e. supplier and processor, manufacturer and retailer, exporter and importer, etc.

Reference materials and testing materials

MoniQA developed and validated several testing materials, which will become (commercially) available to the analytical community. Main focus were incurred materials for food allergen analysis (milk and egg in cookies and infant formulae), standard materials for gluten-free analysis (purified gliadin, gliadin in cookies), and multi-mycotoxin materials containing 11 different mycotoxins in maize, naturally contaminated and spiked. Only the use of generally accepted reference materials, a true or assigned value can assure the comparability of results, correct calibration of methods, and validity of results in laboratories' verification processes.

Collaborative/validation studies/ring trials/comparative studies

MoniQA conducted some 12 validation and/or comparative studies for the analysis of dioxin (using chemical-activated luciferase gene expression and High Performance Liquid Chromatography (HPLC)), milk allergens and gluten/gliadin (ELISA, Lateral Flow Device), food additives (aspartame and saccharin, and sorbic and benzoic acid in fruit juices by HPLC), organic and conventional eggs (carotenoid profiling by HPLC), *Campylobacter* subspecies identification by Polymerase Chain Reaction and comparing various diluents for microbiological analysis, multi-mycotoxin analysis by LC-MS-MS, 'relative' matrix effects in mycotoxin quantification in various food and feed commodities by LC-MS-MS, and rice freshness by the dye colour chart method for rice pH determination. Collaborative studies are the means to test a method under realistic conditions. Such studies in the format of international ring trials estimate the precision of a method and assess the fitness-for-purpose. These studies were performed according to international protocols or guidelines (where available) or by applying the newly developed protocols by MoniQA to prove the concept. The successful organization of the ring trials and the informative outcomes of the studies contributed significantly to harmonization of the quality of analysis of selected contaminants or quality parameters worldwide.

Training and Continued Professional Development

An important issue in harmonization efforts is the common and shared understanding and knowledge of the matters involved in competent food analysis. To assure a harmonized and generally acceptable quality of analytical results, it is of utmost importance that the operator is familiar with the analyte and its occurrence in the food, feed and environment, the analytical method, and the statistical and mathematical tools to generate and calculate a trustworthy result. Training is also part of institution's quality assurance and continued professional development plans. Training also reveals shortcomings and shows new developments, gives opportunity to exchange experiences between analysts who would not meet otherwise, and gives advice when things go wrong and when trouble shooting is required. Harmonisation of the degree of knowledge and understanding contributes to trustworthy results and thus to safer and better quality foods.

Online tools and Quality Assurance (QA) Guides

Harmonisation in more general terms and in procedural environments is necessary to comply to legal requirements and international standards as well as to optimize procedures and improve the quality and safety of foods and feeds. MoniQA developed tools for laboratories, food businesses and policy makers in support of each stakeholder group's interest and responsibility along the monitoring and quality assurance along the food supply chain. Harmonisation of QA tools improves the communication and understanding of processes and impacts of actors along the food production chain/network: (a) MoniQA provided a guide for laboratories for achieving ISO/IEC 17025 accreditation.; (b) MoniQA developed a QA manual for MoniQA trainings; (c) MoniQA developed guidelines for implementation/set up of HACCP in some 10 selected food processing and manufacturing plants; and (d) MoniQA developed a tool box for socio-economic impact assessment in food businesses, legislations, countries, municipalities and communities. These tools contribute to harmonization of food quality and safety by improving food safety management systems as the basis to reduce or minimize risk and to better understand the legal, social, and economic/financial implications of compliance and/or non-compliance to private or legal standards.

Information, databases and links

Harmonising knowledge and understanding of food safety and quality related issues depends largely on the availability of relevant information, fast and user-friendly searchability, and validation/reliability of information. MoniQA developed and provided an online database 'MoniQA FC24' on available analytical methods, associated levels of validation, relevant legal limits and legislation in the EU and

in 20 countries outside the EU, and additional information on the source of data and background information (e.g. risk assessment data and European Food Safety Authority opinion papers) and (harmonized) terminology used in legislation, standards and protocols. MoniQA also provided fact sheets on various analytes and associated methods as well as results on surveys on identified needs, gaps and problems associated with selected food safety and quality issues in the EU and worldwide. Routes of disseminating and increasing the knowledge base of MoniQA's validated information towards harmonization of international standards in monitoring and quality and safety assurance are the MoniQA website, fact sheets and other printed material, and certainly the International Journal of Quality Assurance of Crops & Foods, which was jointly established with the International Association for Cereal Science and Technology (ICC).

Platforms and forums

In an endeavour to assure continuous support among network members and sustainability of the harmonization efforts established during MoniQA, online forums and virtual platforms (working groups, task forces and project consortia) were established during MoniQA and will continue within the MoniQA Association. New research projects will continue to contribute to the harmonization of international standards, the development of improved and reliable analytical methods and to better characterize analytes as a basis for the design and production of generally accepted reference materials.

In total MoniQA involved 33 core partner institutions and some 120 associates from more than 40 countries on all continents and focused on the needs, gaps, and problems associated with an effective food safety and quality management, where the different stakeholder groups from policy makers and standardisation bodies, consumer organisations, science and research institutions, and companies, including food manufacturers, method providers, control laboratories, retailers, etc. had their individual contribution to bear. MoniQA achieved more general acceptance of validation and performance criteria/requirements for methods used to analyse foods and food products for safety and quality with the main focus being on rapid methods and their applicability and reliability in routine testing. MoniQA provided protocols, guidelines, tools, and services and applied the newly developed products as proof of concept for improved and harmonized approaches in monitoring and quality assurance in the total food supply chain worldwide.

4. Outlook

Even though MoniQA NoE has fully achieved its goal to contribute to international standardization and establishing a sustainable network to continue the harmonization efforts within the frame of the MoniQA Association, the work is by far not finished. The growing interest of the various stakeholder groups and the commitment of the members of MoniQA Association underline (a) the significance of closer international collaboration in improving and harmonizing food safety and quality monitoring strategies; and (b) the need to develop generally accepted and practical tools to support food safety and quality management at the various levels along the food production chain and policy development. 'Food safety under global pressure by climate change, food security and economic crises', the title of the 4th MoniQA international conference held in Budapest, Hungary (26 February - 1 March 2013) emphasizes the many facets and the multi-disciplinarity of food safety and quality in a global context. Emerging and persistent food safety issues, and the relevant analytical and legal challenges in perspective of globalisation, climate

change, food security and economic crises are drivers for new developments and new research initiatives in food safety assurance and food safety management worldwide. However, economic challenges and the volatility of food commodity prices put pressure on food safety assurance strategies, especially in developing countries, but also in international trade. According to the definition of 'food security' by the WHO, it is a fundamental right of everyone to be free from hunger and to consume safe and nutritious food. MoniQA recognizes the global challenges related to securing people's access to sufficient, safe and nutritious food, and the various emerging food safety risks associated with climate change, globalization, and economic interests. MoniQA endeavors to facilitate knowledge transfer and global collaboration in food safety and quality aspects to sustain the life and health of those who need to eat to live.

References

ISO, 2005. ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. ISO copyright office, Geneva, Switzerland, 28 pp.