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METROLOGY IN FOOD COMPOSITION DATABANKS: THE EUROPEAN STRATEGY

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ABSTRACT

The European Food Information Resource (EUROFIR) is a network of national Food Composition Databank (nFCDB) compilers that aims to develop, manage and publish food composition data and promote international cooperation and harmonization through improved data quality, database search ability and standards. The aim of this work is to study the role of metrology in harmonization of nFCDB. The criteria for use of nFCDBs to assist measurement processes in dietary assessment, epidemiology, food processing and food technology are described in relation to the EuroFIR quality management framework. The use of SI units of Modes of expressions and Reference Materials are the most important metrological tools to improve the quality of data in nFCDBs.

Keywords: EuroFIR, Data Quality, Metrology in Food and Nutrition

INTRODUCTION

The European Food Information Resource (EuroFIR) is a network of National Food Composition Databank (nFCDB) compilers that aims to develop, manage and publish food composition data and promote international cooperation and harmonization through improved data quality, database search ability and standards[1][2]. One of EuroFIR's main objectives is the development of an integrated food platform that provides single-point access to the various national authoritative sources of food composition data in each Member State, for both nutrients and newly emerging non-nutrient bioactive compounds with putative health benefits [3]. EuroFIR has developed a series of activities to improve communication between producers of analytical data, national database compilers, stakeholders and users [4]. EuroFIR has established a leading role in global harmonization initiatives for food information systems and data and has developed strong strategic links to various international bodies (such as INFOODS, IMEKO, USDA and FDA) in order to harmonise food description and data quality [5]. Metrology, the science of measurement, plays an important role in the EuroFIR platform concept [6]. The platform design includes traceability to SI units of nutrient and non-nutrient bioactive compounds with putative health effects [7]. This work presents the quality framework, and metrological approaches applied within EuroFIR to harmonise the interchange of data and improve the rigour of measurement processes where nFCDB are used to calculate and compare intakes of nutrient and bioactive components based on different national food composition datasets.

MATERIALS AND METHODS

Criteria defined in EuroFIR guidelines were used to define metrological critical points. The principles were based on the framework of ISO standards 9001, 17025 and 17024 that cover requirements for quality management systems and certification. These standards describe what requirements a quality system should meet but not how those requirements should be met and therefore are flexible.

RESULTS

The aim of the work was to study the role of metrology in harmonization of national food composition databanks. The first task was focused on the implementation of a quality framework in food composition database organizations, with emphasis on quality of

analytical work and data quality assessment. In Figure 1 is presented the quality system. To assure the accuracy of values and identification of artificial differences, a quality management framework has been agreed, including metrological requirements for description of foods, components and values.

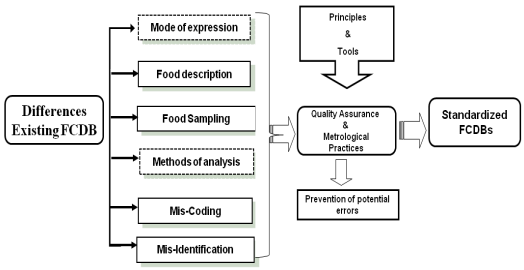

Fig.1: Diagram Showing Quality stategies applied to harmonize Food Composition Databank. Dashed line rectangles indicated metrological intervention

Laboratory producers of analytical data were requested to implement a quality system in compliance with ISO/IEC 17025. The elements providing an indication of analytical reliability are: 1) Validated Methods 2) Robust sampling practices 3) Proven calibration approaches 4) Natural matrix reference materials 5) Assessment of measurement uncertainty and establishment of traceability links to basic SI units 6) Participation in Proficiency testing schemes. EuroFIR has been the first international organisation to delineate these requirements for analytical processes which reveals crucial to guarantee the linkage of overall measurement process adopted Food Composition arena.

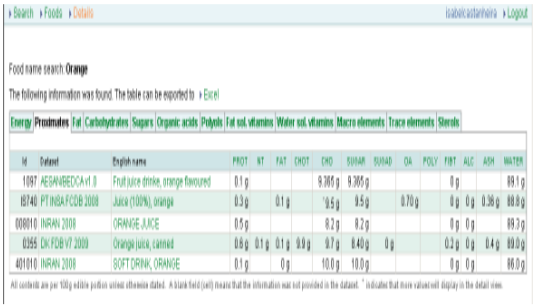

Fig.2: Example of EuroFIR Platform prototype based on datasets collected during EuroFIR NoE.

Following the analytical production of food composition data, the compilation process is the next most important step in production of food composition data. The internationally recognised and recommended systematic approach to the identification, evaluation and control of significant hazards, Hazard Analysis Critical ControlPoints (HACCP), was used as a starting point [8]. All steps in the compilation process were listed and presented as a generic EuroFIR flowchart describing the overall food data compilation process and identifying hazards and critical control points. The flowchart and standard operating procedures, documenting how to control hazards at critical control points, are considered essential elements of the EuroFIR quality framework.

Because food composition data is supported by analytical values that generate single or aggregate values we studied the impact of harmonization to SI units in all values (nutrients and matrix) from analysis through to the compilation process. For the compilation process a set of standard vocabularies (thesauri) was defined to overcome previous problems in earlier attempts to harmonize the interchange of data at international level [9]. This is presented in Figure 2. The SI of units was adopted as the unique system for expression of numeric information, in nFCDB and as a consequence two sets of standard vocabulary were defined. The Unit thesaurus contains terms for the measure used for the amount of the component value (nutrient or bioactive compound) or measurable property reported as the value. The Matrix Unit (Modes of expression) thesaurus contains terms for the amount of the matrix material (food) that has quantity reported as the value, usually expressed using the preposition 'per', e.g. per 100 g of dry weight, per kg of dry weight.

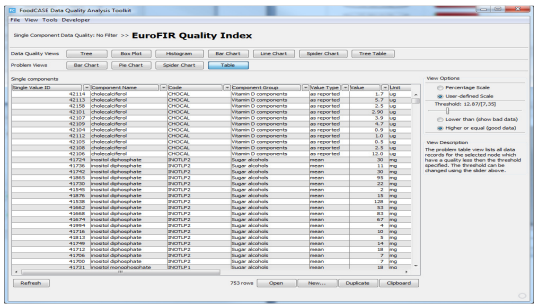

Fig.3: Single food details of datasets, including quality index and metrological parameters

To determine and compare the quality of nutrient values within datasets, systems for assessment of their documentation have been developed [10]. Example is presented in Figure 3. The quality assessment scales developed by EuroFIR NoE are currently limited to application to scientific literature and include seven criteria; food description, sampling

protocol, number of samples analyzed, sample handling, analytical method, execution of the analytical method by the laboratory and quality control in the laboratory. Therefore some metrological tools such as traceability to SI units and reference materials play an important role in data quality assessment during the compilation process, where they are used as criteria for evaluating the analytical quality of values. When it comes to the interchange of data between compilers, RMs serve as criteria for data comparability, and SI units are used to ensure comparability of single or aggregate values that enter Food Composition Databanks. SI units play a crucial role in recipe calculation example is presented in Figure 4

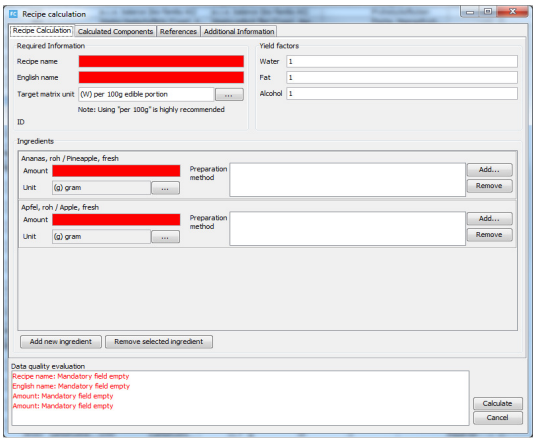

Fig.4: Example of recipe calculation showing the compulsory use of SI units.

The EuroFIR Nexus project, funded by the European Commission, is developing guidelines for assessment of quality management processes used by nFCDB compilers. A programme of peer review assessment of compilers will take place during 2012 and results will be used to prepare 'best practice' guidelines for compilers.

CONCLUSIONS

The assessment of quality management systems used by compiler organizations is an important part of EuroFIR's activities. A policy of quality at the highest level can be extended to the international food composition arena to further build on previous initiatives in order to improve the traceability and reliability of nutrient values and bioactive compounds. These advances will have a considerable impact in the emerging field of metrology in food and nutrition and increase user confidence in food composition data across European countries, and beyond.

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