



**EUROPEAN COMMISSION**  
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# **Compilation of Standardised Analytical Methods for the Analysis of Active Ingredients in Functional Foods**

**M. Buchgraber, A. Karaali**

**European Commission, Directorate-General Joint Research Centre,  
Institute for Reference Materials and Measurements**

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Institute for Reference Materials and Measurements

**Contact information**

Dr Manuela Buchgraber  
European Commission  
Directorate-General Joint Research Centre  
Institute for Reference Materials and Measurements  
Retieseweg 111  
B-2440 Geel • Belgium

E-mail: [manuela.buchgraber@cec.eu.int](mailto:manuela.buchgraber@cec.eu.int)

Tel.: +32 (0)14 571 819

Fax: +32 (0)14 571 787

<http://www.irmm.jrc.be>

<http://www.jrc.cec.eu.int>

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## **ABSTRACT**

In 2003, the European Commission issued a Regulation on Nutrition and Health Claims made on Foods [1], which will provide legal security and specify the conditions for the use of nutrition and health claims, prohibiting certain claims. It should enter into force by 2005. A perceived need was recognised for a careful investigation into the availability of standardised analytical methods to verify compliance with labelling at least of the composition. Consequently, these methods could be used with confidence by regulatory agencies, regulated industry, product testing laboratories and academic institutions. The JRC participated in a study entitled 'Current and Future Developments of Functional Foods in the European Union', coordinated by the Institute for Prospective Technological Studies (IPTS) within the network of the European Science and Technology Observatory (ESTO). As a result the Institute for Reference Materials and Measurements (IRMM) has compiled a database on standardised analytical methods that could be considered for the analysis of active compounds in functional foods.

## 1. Introduction

The term “Functional Foods” was first introduced in Japan in the mid-1980s and refers to processed foods containing ingredients that aid specific body functions, in addition to being nutritious. Currently, there is no precise, universally accepted definition of “Functional Foods”. The term is defined and used differently in various countries. A variety of terms, more or less related to the Japanese Foods for Specified Health Use (FOSHU), have appeared world-wide including more exotic terms, such as nutraceuticals, designer foods, medifoods, vitafoods and the more traditional dietary supplements and fortified foods. Nonetheless, successful or not, the term “Functional Foods” has become the predominant one. These are foods or food products marketed with the message that they may provide a health benefit beyond the traditional nutrient content. Indeed, the term may be misleading, because almost all foods, regardless of whether they contain added ingredients, somehow effect health by providing calories and nutrients and can be considered “functional”. The number of “Functional Foods” is potentially very large and encompasses natural foods, isolated components from these foods that are added to other foods, and food components synthesised in the laboratory, yet resembling conventional foods. They have either higher amounts of a biologically active substance than the conventional food or have been enriched with a bioactive ingredient not usually present.

Consumers today are interested in the information appearing on product labels. Therefore, it is important that the information about food composition and nutritional value is clear, accurate and meaningful. In 2003, the European Commission issued a Regulation on Nutrition and Health Claims made on Foods [1], which will provide legal security and specify the conditions for the use of nutrition and health claims, prohibiting certain claims. It should enter into force by 2005. A perceived need was recognised for a careful investigation into the availability of standardised analytical methods to verify compliance with labelling at least of the composition.

Compositional analysis of food products is crucial for guaranteeing food quality and safety. From the analytical perspective, food analysis is an extremely challenging area. There is a wide variety of questions, ranging from the quantification of extremely low levels of individual components to the detailed characterisation of the major ingredients such as triglycerides or proteins. The analytical evaluation of food and dietary products has evolved significantly as a result of the functional food debate and the scientific and regulatory requirements thereof. The ability to identify and quantitatively measure levels of nutrients and other compounds has become even more essential as a tool to differentiate products in the marketplace. While the measurement of the traditional macronutrients such as protein, fat and minerals, relies on basic chemical techniques, the identification of more specific components, such as individual polyphenols is a complex process involving intricate extraction, detection and measurement phases. Polyphenols constitute one of the most numerous and widely distributed groups of substances in the plant kingdom, with more than 8000 phenolic structures currently known.

In many cases information about these components is relatively sparse. Of the hundreds of methods developed, only a small percentage attains official status. Although, the pressure to adopt these methods is intense, they must meet the standards required to withstand scientific scrutiny and must be validated using established and well-designed criteria. Most researchers agree that any food designated as “functional” and ascribed specific health benefits should receive

scientific scrutiny before specific health claims are permitted. The ability to verify the presence (i.e. detection and quantification) of the active compound is an essential prerequisite for the successful investigation of functional foods. Safe levels of intake must be considered when evaluating functional foods in the context of a healthy diet. For the majority of research studies, the optimal levels of nutrients and other physiologically active components in functional foods have yet to be determined in humans. However, for the majority of functional food components, precise levels of recommended intake can be established only when adequate scientific evidence and analytical methodology fit-for-purpose exists. As a response to the proposed Regulation [1], a compilation of available standardised analytical methods was made that could be considered for suitability in the process of method selection for the analysis of active compounds in functional foods.

## **2. Conception of the data base**

In order to organise the information obtained from the considerable number of harmonised analytical methods gathered, a Microsoft Access® database has been designed. The following items are listed in the database:

- Identification Number (Consecutive number in the database, given by the author)
- Group Name (2.1)
- Compound Class
- Compound Subclass
- Compound Target
- Compound Notes (Remarks related to the compounds)
- Natural Sources (Examples for possible natural sources of the compound)
- Method Source (2.2)
- Method Number
- Method Title
- Publication
- Method Notes (A short principle of the standardised method is summarised)
- Matrix/ces
- Health Claims (Examples for possible health claims are listed)

### ***2.1. Group name***

In order to systemise the impressive number of so-called functional components a classification, oriented to the chemical structure of the active compounds, was expounded upon. The classification done within the ESTO study comprises the following 9 groups:

- Phenols
- Terpenes
- Saccharides
- Lipids
- Peptides
- Fibres
- Unspecified plant extracts
- Bacteria cultures
- Miscellaneous

It is a slightly modified version of a Japanese classification proposed by Ichikawa [2], which involves 12 groups, including e.g. minerals and vitamins, which are out of the scope of this study. If possible, the active compound was further classified using the items “Compound Class” and “Subclass”.

## **2.2. Method source**

The following method sources were used to search for standardised analytical methods:

- International Organisation for Standardisation (ISO)
- European Committee for Standardisation (CEN)
- Online compendium of Joint FAO/WHO Expert Committee on Food Additives (JECFA)
- Amtliche Sammlung von Untersuchungsverfahren § 35 LMBG (LMBG)
- Official Methods of Analysis of AOAC International (AOAC)
- Official Methods and Recommended Practices of the American Oil Chemists Society (AOCS)
- Approved Methods of the American Association of Cereal Chemists (AACC)
- Online compendium of International Olive Oil Council (IOOC)
- Online compendium of International Dairy Federation (IDF)
- Online compendium of Institute for Nutraceutical Advancement (INA)
- Online compendium of European Pharmacopoeia (EP)

## **3. Results**

In total 223 methods (Annex) have been collected, which account for about 100 individual compounds. The compilation is limited so far to standardised analytical methods, which if applied, would help to ensure that the data produced can stand up to scrutiny.

The investigation has shown that there is still a lack of available, reliable and harmonised analytical methods for many components used in the field of functional foods due to the tremendous challenges posed by the rapidly increasing number of functional components. Moreover, validated, standardised methods are only available for a few specific matrices. Even if existing methods, modified for a new matrix, may undergo a less-extensive validation process, the validation steps still have to be followed. This compilation can only be seen as a preliminary approach. A more detailed exploration including methods published solely in literature would show that much more methods have already been developed. However, only a small percentage will attain official status.

## **4. Conclusion**

The ability to efficiently develop, validate and implement a new method is an essential prerequisite for the successful completion of an analytical study. A full validation requires a comprehensive evaluation of a variety of components which indicates not only the accuracy of the data, but the scientific limits and parameters as well. Researchers have to focus on developing and validating methods to fill the gap

and to satisfy the continuing need for reliable standardised analytical methods, which can offer an important measure to assess compliance with labelling provisions.

## **5. References**

[1] Proposal for a Regulation of the European Parliament and of the Council on nutrition and health claims made on foods – 2003/0165 (COD).

[2] T. Ichikawa, In: I. Goldberg (Ed.), Functional foods, designer foods, pharmafoods, nutraceuticals, New York, 1994, p. 453.

## **ANNEX**

European Commission

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