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FOOD COMPOSITION DATABASES

Introduction

Food composition databases (FCDBs) are essential resources of nutrition science (McCance and Widdowson 1940). Their use, however, is far from being limited to the field of nutrition science and the public health domain. Food industry, legislation, policy development, agriculture or consumers all need and/or use data on food composition as well (Williamson 2006). Originally, these resources existed only in printed form, with the oldest tables dating back to the early 1800s. Nowadays, a trend towards electronically available FCDBs can be observed and more recently, many of them have become available online on the Internet. They can hold large amounts of data and allow easy access to and manipulation of data. The standardisation and harmonisation of FCDBs worldwide is not only of great benefit for the classical uses of food composition data (FCD), which are outlined below. Together with improved data quality, increased accessibility to and better compatibility between FCDBs, they will certainly also increase the application of Information and Communication Technologies to FCD and open gates for new FCDB uses.

What are food composition databases?

The FCDBs provide detailed information on the nutritional composition of foods, usually from a particular country, or region, and have a variety of important uses. FCDBs usually contain values for energy and macro- and micronutrients for each of the foods listed representing the main foods consumed in that country or region. In addition, some FCDBs have values for individual amino acids and/or vitamin fractions (e.g. individual carotenoids, such as lycopene and lutein). In addition, some specialised databases are also available, for example, eBASIS – the database on bioactive compounds with putative health benefits (Gry et al. 2007, EuroFIR eBASIS database, 2010) the US isoflavone database (<http://www.nal.usda.gov/fnic/foodcomp/Data/isoflav/isoflav.html>), the French Phenol-Explorer database (<http://www.phenol-explorer.eu/>) and food allergens (e.g. Informall Food Allergens database, (<http://foodallergens.ifr.ac.uk>)).

Generally, the compositional values are based either on chemical analyses, which are carried out in analytical laboratories, or are calculated or estimated from other appropriate data. The number and range of foods covered varies by FCDBs and some databases include a wider range of processed foods, composite dishes and recipes as well as foods prepared and cooked in different ways. For example, cod fish might be included as fresh, frozen, dried, raw, grilled, baked, fried in different fats and oils, coated in batter, or breadcrumbs, or salted. Before the advent of the computer era, and in particular, before the arrival of the fast Internet, the FCDBs only existed in printed form, with the oldest tables dating back to the early 1800s. Over the last five years there has been a significant trend towards electronically available FCD and in Europe the online availability of national FCDBs has dramatically increased from about 5 in 2005 to over 20 in 2010, mainly due to the EuroFIR Network of Excellence project, funded by the European Union (<http://www.eurofir.org>). The establishment of this European Food Data Platform is recognized as an important underpinning requirement essential to the improvement of pan-European food and health research, and supporting the development of European public health policy. Additionally, as international trade and scientific collaboration continually increase, there is a growing requirement for FCD to be compatible at an international level (Williamson & Buttriss 2007).

While FCD are fundamental information resources to many fields of work, especially in public health and nutrition, they do have limitations. These include:

- Variability in the composition of foods between countries, owing to, for example, season, cultivar or variety, brand, fortification levels
- Incomplete coverage of foods or nutrients leading to missing values
- Incomplete documentation on the values including quality indices
- Age of data (limited resources mean that, inevitably, some values are not current)

How are food composition databases established?

A variety of methods are used to compile FCD at a national level by many countries including: chemical analysis of food samples, calculation of values using yield and nutrient retention factors; 'borrowing' values from one FCDB to another, adopting values from other sources, e.g. scientific literature for analysed values or food labels for branded foods.

Chemical analysis of samples that are representative of the foods being consumed in a country is usually the preferred method for producing FCD. Food samples are carefully chosen according to a defined sampling plan based on nutritional importance in the diet and dietary consumption patterns. Food samples are collected, transported to an analytical laboratory and stored in an appropriate way. If necessary, further preparation and cooking takes place prior to the analysis using appropriate analytical methods. Owing to limited resources, it is not feasible to determine these levels of every nutrient in every food. National FCDB compiler organisations therefore use other approaches to determine the required nutrient values within a FCDB. For example, values for a raw food or dish can often be used, in conjunction with information on likely weight and nutrient changes due to cooking, to estimate values for a cooked food. This recipe calculation approach incorporates adjustments for weight change (or yield) on cooking and changes in the nutrient content on cooking (e.g. vitamin losses). It allows the provision of FCD for single foods, e.g. carrot (raw or prepared) as well as composite

foods, e.g. salads or soups (i.e. raw or prepared) in FCDBs in Europe and beyond (Reinivuo et al. 2007 and Vásquez-Caicedo et al. 2008). EuroFIR has developed a series of harmonised nutrient retention and yield factors for improved data harmonisation and compatibility between countries (EuroFIR guidelines on recipe calculation 2008).

Another approach commonly used by FCDB compilers is to 'borrow' or 'adopt' nutrient values that were originally compiled by another organisation. When using this approach, compilers will ensure that borrowed data are compatible with their own database. Commonly used data sources for borrowed data are FCDBs from other countries or manufacturers' data (e.g. from food labels). Before incorporating data from any of these sources into their FCDBs, compilers will evaluate the data in terms of both data quality and applicability of foods to the database. Information about the food, the nutrient values and their derivation will also be documented, so that compilers and users of the database can access these details.

Which food composition databases are available worldwide?

Australia/New Zealand

The Australian Food Composition Program from the Food Standards Australia New Zealand

(<http://www.foodstandards.gov.au/consumerinformation/foodcompositionprogram/>)

publishes two databases: NUTTAB, a reference database

(<http://www.foodstandards.gov.au/consumerinformation/nuttab2006/>) and AUSNUT

(<http://www.foodstandards.gov.au/consumerinformation/ausnut2007/>) covering the results of food consumption surveys.

Canada

The Canadian Federal Department Health Canada publishes two FCDBs, which list nutrient values in Canadian foods. The Canadian Nutrient File (CNF) is a comprehensive, computerized bilingual database that reports up to 150 nutrients in over 5807 foods. The CNF has an online, searchable database that allows Canadians to search the nutrient values for specific foods (<http://www.hc-sc.gc.ca/fn-an/nutrition/fiche-nutri-data/index-eng.php>). The department also periodically produces the Nutrient Value of Some Common Foods (NVSCF) booklet to provide a portable reference of the most popular foods in the Canadian marketplace. This booklet lists 19 nutrients for 1000 of the most commonly consumed foods in Canada and has just been updated (http://www.hc-sc.gc.ca/fn-an/nutrition/fiche-nutri-data/nutrient_value-valeurs_nutritives-eng.php).

East Asia

The publication of the Food Composition Tables for Use in East Asia was a research project sponsored by the U. S. Department of Health, Education and Welfare and FAO's Food Policy and Nutrition Division. More information is available at: <http://www.fao.org/docrep/003/X6878E/X6878E00.htm>.

Europe

Most European FCDBs are linked to the European Food Information Resource (EuroFIR), which was a five-year Network of Excellence funded by the European Commission's Research Directorate General under the "Food Quality and Safety Priority" of the Sixth Framework Programme for Research and Technological Development. The primary aim of EuroFIR was the harmonisation and standardisation of FCDBs in Europe.

The network continues existing as a non-profit organisation (the EuroFIR AISBL), which provides online access to 27 national FCDBs available in Europe (<http://www.eurofir.org>).

Japan

The Japanese Food Composition Database is available at http://database.food.sugiyama-u.ac.jp/index_asia.php.

Latin America

LATINFOODS is the Latin American network on food composition (Sammán et al. 2009) involving research institutions from 19 countries and being cosponsored by FAO and UNU. The network is dedicated to develop and strengthen regional activities in food composition and its dissemination (<http://www.inta.cl/latinfoods/>).

South Africa

The FCDB was developed by the Nutritional Intervention Research Unit of the South African Medical Research Council and is online available for users at <http://www.mrc.ac.za/FoodComp/>.

USA

The U.S. Department of Agriculture with the Nutrient Data Laboratory and the Agricultural Research Service publishes the USDA National Nutrient Database for Standard Reference, with the most recent Release 23 from 2010. (http://www.ars.usda.gov/main/site_main.htm?modecode=12-35-45-00). Additionally, the Dietary Supplement Ingredient Database, Release 1 (<http://dietarysupplementdatabase.usda.nih.gov/>) is also available online.

Links to further INFOODS regional networks can be found under <http://www.fao.org/infoods/>.

Further information to some examples of FCDB can be found on the website of the International Nutrient Databank Directory, which introduces one to different types of FCDB and key factors to consider when choosing a FCDB (<http://www.nutrientdataconf/indd/index.cfm?event=databases>).

Who uses food composition data?

As one of the essential resources of nutrition sciences, FCDBs are crucial for a variety of purposes including nutrition and epidemiological research, clinical dietetic practices, product development and food labelling by industry, food and health monitoring by government food and health departments and nutrition education (Williamson 2006).

One of the most important uses of FCD is in the assessment of nutrient intake at the individual, regional, national or international level. Dietitians and other health practitioners use FCD to assess the diets of their patients, while epidemiologists need to assess diet in order to study the role of food components and their interactions in health and disease. This also includes international epidemiological studies and multi-centre research.

National government agencies often assess diets at the population level, through national food consumption surveys, in order to monitor trends in nutritional status and to evaluate the impact of nutrition policy. FCDBs are also widely used in the development of recipes, meals and menus for therapeutic diets, institutional catering and the commercial foodservice industry. Dietitians and clinicians need to design therapeutic diets for patients with specific nutritional requirements associated with their condition (e.g. metabolic disorders, diabetes). FCDBs help them to identify foods that are good sources of nutrients of interest. With the increasing focus on children's diets, menus in schools and childcare settings can be assessed against nutritional standards, often using specially designed meal planning software.

FCDBs are also an important tool in planning menus in schools, care homes, hospitals and prisons to ensure adequate nutrient content. There is also a move towards the provision of point-of-sale nutritional information in foodservice outlets, which has increased the application of FCD in the foodservice industry. The demand for point-of-purchase information on nutrient content has also been a driving force behind the inclusion of nutritional information on food labels. This is in the form of nutrition panels and, increasingly, front-of-pack or 'signpost' labelling, which provides information for consumers in a simplified format (Williamson 2006).

Nutrient profiling, a tool developed by the European Food Safety Authority (EFSA) for categorising foods on the basis of their nutrient content, is a relatively new application of FCDBs (EFSA 2009). It will help assess the eligibility of foods to bear nutrition and health claims under new EU regulations. Other uses of FCD in relation to food manufacturing include optimisation of product composition when developing new products.

FCD are also used to help identify the needs of nutrition education and health promotion and to implement appropriate strategies, such as targeted interventions. They form an integral part of, and an educational resource for, food and nutrition training in schools, tertiary education and, increasingly, in workplace settings. They also have more general applications in agriculture and trade. For example, FCD can be used to monitor the nutrient content, safety and authenticity of foods. Improvements to the food supply, such as plant breeding, and new methods of cultivation, harvesting and preservation can be assessed using FCD. Finally, they form part of the evidence base in support of initiatives on nutrition and biodiversity.

Advances in information technologies allowing rapid transmission of large data volumes (e.g. third generation cell phone technologies 3G, WLAN) encourage the development and dissemination of consistent and coherent FCD through multiple channels, in forms appropriate to local culture, age and needs. In the future, food or health information from web portals could be retrieved at the time and location (at home or in shops) as needed, through the use of ultra mobile computers, mobile phones or stationary devices having incorporated access to the Internet (Colombani et al. 2007 & Bell et al. 2008).

EuroFIR's eSearch facility (EuroFIR eSearch facility 2010), a meta-search engine, which enables the simultaneous online search of the national FCDBs linked with EuroFIR, is such a portal and is likely to become a leading food information source. Data from 27 European countries is available in the search facilities, which includes options to search on food name, food description and a combination of food name and food description as well as the powerful and unique ability to compare the component values between foods from across Europe countries.

Data management and quality aspects

The provision of high quality data that is fit-for-purpose is one of the most important aspects when considering available FCD and quality aspects are indispensable as well for FCD management systems (see below). The quality of FCD is derived from several aspects of each single value and is comparable with the evaluation of the method part of a scientific paper (Castanheira et al. 2009). If the methodology is not sufficiently accurately documented, or the methodology is not adequate, a poor quality is likely to be assigned to the results in that paper and the data will be of limited or no scientific value. Correspondingly, the quality of FCD is an essential feature of FCD that should be known whenever FCD is used. The quality evaluation of FCD requires description of the food, the component, the component value, sample plan and number of samples, sample handling and analysis, together with some information on the performance of the laboratory making the measurements.

In Europe, guidelines are available for compilers documenting the procedures of quality evaluation and quality index attribution to original data from scientific literature and laboratory reports, as well as for data, which represent the heterogeneous group of non-analytically generated data in a FCDB (e.g. food labels, data borrowed from other FCDBs and calculated or estimated data). Therefore, skilled and experienced technical experts are continuously working towards improving the content and quality of the data in their national FCDBs. The data are thoroughly documented for best possible transparency, aggregated, validated and compiled following strict and standardised quality evaluation procedures before they can be published in the FCDBs and be made available for all data users. The provision of a quality index for each value will be one of the aims of the FCDBs in the future, increasing the usefulness of the data for all users (Westenbrink et al. 2009).

Further, to ensure the constant provision of high quality and standardised data, FCD compilers benefit from the availability of revised analytical guidelines and harmonised principles for food description and classification in Europe. Food description forms an

essential attribute of any standard related to FCD. One of the available tools to describe and index foods is LanguaL (Ireland & Møller 2010; LanguaL 2010). LanguaL (*Langua Alimentaria*) is a structured system for describing foods with multiple facets, and is well suited to the systematic retrieval of data from numerical databases, making linking of different FCDBs and datasets possible (Møller et al. 2007).

New recommendations in the form of a new European standard on food data within the framework of the European Committee for Standardisation (CEN) have been drafted and are currently under consideration by national standardization bodies (Becker 2010, CEN on EuroFIR 2010). The standard covers the development, management and publication of FCD according to common principles, and that data are described and presented, with their metadata, in a uniform way.

Furthermore, it is planned in the future that the national FCDB compiler organisations should be certified for their work in order to ensure competence and adherence to the food data standard. The quality framework approach developed by EuroFIR (Westenbrink et al. 2009) has been designed with consultations with both national FCDB compiler organisations, laboratories that generate new data and other key users/stakeholders and is sufficiently flexible and enhances the consistency, transparency and interchange of data and datasets for food and nutrition research and other purposes.

Sustainability for food composition data activities

INFOODS

The International Network of Food Data Systems (INFOODS 2010) was established in 1984 on the basis of the recommendations of an international group convened under the auspices of the United Nations University (UNU). Its goal was to stimulate and coordinate efforts to improve the quality and availability of food analysis data worldwide and to ensure that anyone anywhere would be able to obtain adequate and reliable FCD. In furtherance of these purposes INFOODS has provided leadership and administrative framework for the development of standards and guidelines for collection, compilation, and reporting of food component data. It is establishing and coordinating a global network of regional data centres directed toward the generation, compilation and dissemination of accurate and complete data on food composition. It is also the generator and repository of special international databases and serves as a general and specific resource for persons and organizations interested in FCD on a worldwide basis. Its secretariat has developed the necessary software for the electronic storage of FCD and its interchange among databases. The INFOODS effort is intrinsically interdisciplinary, depending on the efforts of food scientists, analytical chemists, and nutritionists working together with computer and information scientists.

From its inception as a UNU project, INFOODS has recognized the Food and Agriculture Organization's (FAO) early development and distribution of regional food composition tables, and a representative of FAO has participated in all technical and policy meetings of INFOODS. In March of 1994, FAO and UNU organized an international discussion on "Food Composition for Developing Countries", where FAO has renewed its commitment to improving the quality and availability of FCD in developing countries after an interval of many years. As part of this new effort, FAO

joined UNU in the promotion of the INFOODS project. Priority is currently given to mobilizing resources for improving the quality, quantity and accessibility of FCD in the developing world. New regional databases have been prepared and developing countries are now able to interchange data with each other.

Furthermore, the INFOODS network launched the first version of the FCDB for Biodiversity on 15th December 2010, as a collection of analytical data from the published and unpublished literature. It is hoped that this database will grow in the

future with more data from around the world
(http://www.fao.org/infoods/tables_int_en.stm).

EuroFIR AISBL

One of the key achievements of the EuroFIR project was the establishment of the legal entity EuroFIR AISBL (Association Internationale Sans But Lucratif), a non-profit, member-based association of FCD compilers, expert users and stakeholders, based in Belgium (Finglas et al. 2010). Its main aim is to provide continued support to the European national compiler organizations, offering data access and services to users of FCD in Europe and beyond. EuroFIR AISBL unifies all the expertise, standards and guidelines developed during the EuroFIR project and is therefore able to provide a key interface between the national FCDB compiler organisations and their national funders and stakeholders, including a network of laboratories producing the data, with users of FCD from industry, academia and regulatory affairs. It also promotes and develops appropriate quality assurance and traceability principles, facilitating the implementation of relevant international standards. EuroFIR AISBL forms part of the global INFOODS network of international FCDB compiler organisations and collaborates on several initiatives such as training and the harmonisation of food standards.

References and useful websites

1. Australian Food Composition Program. NUTTAB (2011), available at: <http://www.foodstandards.gov.au/consumerinformation/nuttat2006/>. Accessed on 2011-05-06.
AUSNUT (2011), available at: <http://www.foodstandards.gov.au/consumerinformation/ausnut2007/>. Accessed on 2011-05-06.
2. Becker, W, (2010). Towards a CEN Standard on food data. European Journal of Clinical Nutrition (2010) 64, Page 49–52.
3. Bell, S, Colombani, P C, Christensen, T (2008). Report on New Users and New Uses of Food Composition Databases Outside the eHealth Area. Available at: http://www.eurofir.org/eurofir_knowledge/uses_and_users. Accessed on 2010-11-25.
4. Canadian Nutrient File (2011), available at: <http://www.hc-sc.gc.ca/fn-an/nutrition/fiche-nutri-data/index-eng.php>. Accessed on 2011-05-06.

5. Castanheira, I, Roe, M, Westenbrink, S, Ireland, J, Møller, A, Salvini, S, Hedwig Beernaert, H, Oseredczuk, M, Calhau; M A (2009). Establishing quality management systems for European food composition databases. *Food Chemistry*, Volume 113 (3), Pages 776-780.
6. CEN/TC387 'Food Data' on EuroFIR (2010). Available at: http://www.eurofir.org/eurofir_knowledge/cen_standard. Accessed on 2010-11-25.
7. Colombani, P C, Von der Crone, M, (2007). Report on existing innovative tools within the eHealth area which already include food information or in which food information might be included. Available at: http://www.eurofir.org/eurofir_knowledge/uses_and_users. Accessed on 2010-11-25.
8. East Asia Food Composition Tables (2011), available at: <http://www.fao.org/docrep/003/X6878E/X6878E00.htm>. Accessed on 2011-05-06.
9. EFSA (2009), The EFSA's 9th Scientific Colloquium - Nutrient Profiling For Foods Bearing Nutrition and Health Claims. Available at: <http://www.efsa.europa.eu/en/colloquianutrientprofiling/publication/colloquianutrientprofiling.htm>. Accessed on 2010-11-25.
10. EuroFIR eBASIS (2010), available at: <http://ebasis.eurofir.org>. Accessed on 2010-11-25.
11. EuroFIR eSearch facility (2010), available at: <http://esearch.eurofir.org>. Accessed on 2010-11-25.
12. EuroFIR guidelines on recipe calculation (2008). Available at: http://www.eurofir.org/eurofir_aisbl/compiler_guidelines/recipe_calculation. Accessed on 2010-11-25.
13. European Food Information Resource (EuroFIR) (2010), available at: <http://www.eurofir.org>. Accessed on 2010-11-25.
14. Greenfield, H and Southgate, DAT (2003). *Food Composition Data, Production, Management and Use*, FAO, Rome. Available at: http://www.fao.org/infoods/publications_en.stm. Accessed on 2011-01-04.
15. Finglas, P, Weichselbaum, E, Buttriss, J L, (2010). The 3rd International EuroFIR Congress 2009: European Food Composition Data for Better Diet, Nutrition and Food Quality. *European Journal of Clinical Nutrition* (2010) 64, Page 1–3.
16. Gry, J, Black, L, Eriksen, F D, Pilegaard, K, Plumb, J et al., (2007). EuroFIR-BASIS – a combined composition and biological activity database for bioactive compounds in plant-based foods, *Trends in Food Science & Technology* 18 (8), 434-444.

17. INFOODS (2010), available at: http://www.fao.org/infoods/index_en.stm. Accessed on 2010-11-25.
18. Informall Food Allergens Database (2010), available at: <http://foodallergens.ifr.ac.uk>. Accessed on 2011-05-06.
19. Ireland, J, Møller, A, (2010). LanguaL Food Description: a Learning Process. European Journal of Clinical Nutrition (2010) 64, Page 44–48.
20. Japanese Food Composition Database (2011), available at: http://database.food.sugiyama-u.ac.jp/index_asia.php. Accessed on 2011-05-06.
21. LanguaL (2010), available at: <http://www.langual.org>. Accessed on 2010-11 25.
22. LATINFOODS (2011), available at: <http://www.inta.cl/latinfoods/>. Accessed on 2011-05-06.
23. McCance, R. A. and Widdowson, E. M. The chemical composition of foods. 1940. London, His Majesty's Stationery Office. Special Report Series, No. 235. Medical Research Council.
24. Møller, A, Unwin, I D, Becker, W, Ireland, J (2007). EuroFIR's food databank systems for nutrients and bioactives, Trends in Food Science & Technology 18 (8), Pages 428-433.
25. Phenol-Explorer database (2010), available at: <http://www.phenol-explorer.eu>. Accessed on 2011-05-06.
26. Reinivuo, H and Laitinen, K (2008). Proposal for the harmonisation of recipe calculation procedures (D2.2.12/M2.2.4), EuroFIR. Available at: http://www.eurofir.org/eurofir_aisbl/compiler_guidelines/recipe_calculation. Accessed on 2010-08-05.
27. Sammán, N, Oyarzun, MT and de Pablo, S (2009). LATINFOODS, the Latin American Network of Food Composition, Food Chemistry 113 (3), Pages 795-798.
28. South African Food Composition database (2011), available at: <http://www.mrc.ac.za/FoodComp/>. Accessed on 2011-06-05.
29. US Dietary Supplement Ingredient Database, Release 1, available at: (<http://dietarysupplementdatabase.usda.nih.gov/>). Accessed on 2011-05-06.
30. US Isoflavone database (2011), available at: <http://www.nal.usda.gov/fnic/foodcomp/Data/isoflav/isoflav.html>. Accessed on 2011-05-06.

31. USDA National Nutrient Database for Standard Reference (2010), available at: http://www.ars.usda.gov/main/site_main.htm?modecode=12-35-45-00. Accessed on 2011-05-06.
32. Vásquez-Caicedo, AL, Bell, S, Hartmann, B (2008): Report on collection of rules on use of recipe calculation procedures including the use of yield and retention factors for imputing nutrient values for composite foods (D2.2.9), EuroFIR. Available at: http://www.eurofir.org/eurofir_aisbl/compiler_guidelines/recipe_calculation. Accessed on 2010-08-05.
33. Westenbrink, S, Oseredczuk, M, Castanheira, I, Roe, M, (2009). Food composition databases: The EuroFIR approach to develop tools to assure the quality of the data compilation process. Food Chemistry, Volume 113 (3), Pages 759-767.
34. Williamson, C (2006). Synthesis report No 2: The Different Uses of Food Composition Databases, EuroFIR. Available at: http://www.eurofir.org/about_us/eurofir_publications/synthesis_reports. Accessed on 2010-08-05.
35. Williamson, C, Buttriss, J L (2007). EuroFIR Congress 2006: Food Information Databank Systems – everything you ever wanted to know, Trends in Food Science & Technology 18 (8), Pages 398-406

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The International Union of Food Science and Technology (IUFoST) is the global scientific organization representing over 200,000 food scientists and technologists from more than 65 countries. It is a federation of national food science organizations linking the world's food scientists and technologists. IUFoST has four regional groupings: ALACCTA representing Central and South America, EFFoST representing Europe, WAAFoST representing Western Africa and FIFSTA representing the countries in the ASEAN region.

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