

INFOODS: the international network of food data systems^{1,2}

Nevin S Scrimshaw

ABSTRACT A 1983 conference organized by United Nations University proposed an international network of food data systems (INFOODS) to address the need for and limitations of food-composition databases. Concerns of INFOODS include the acquisition and interchange of quality data on the nutrient composition of foods; the development of standards and guidelines for the collection, compilation, and reporting of food-component information; and support of a worldwide network of regional data centers for the generation, compilation, and dissemination of information on food composition. One goal of these centers is to assist in the development of appropriate national databases, especially in developing countries. Much has been accomplished by INFOODS, despite limited resources. Several important documents on food composition have been published, an international journal of food composition has been established, a directory of existing food-composition databases has been compiled, specific recommendations for the construction and use of food-composition databases have been developed, and a system of food nomenclature and coding has been created. Regional food-composition databases have been established throughout the world, with the goal of creating computerized systems that permit easy availability and interchange of food-composition data between regions and countries. In 1993 the Food and Agriculture Organization renewed its interest in the food-analysis capability of developing countries by becoming involved in INFOODS efforts. *Am J Clin Nutr* 1997;65(suppl):1190S-3S.

KEY WORDS INFOODS, United Nations University, Food and Agriculture Organization, food composition, tables, regional data center, food-composition database, nutrient composition

INTRODUCTION

Most of the time, the final objective of methods of assessing dietary intake is to calculate specific nutrient intakes from intake data. The reliability of such calculations depends not only on the accuracy of food-consumption estimates but also on the food-composition data on which these estimates are based. There is, therefore, an equal need to recognize the inadequacies of food-composition databases and the difficulty of matching foods as they are eaten to entries in those databases.

In the 1940s and early 1950s, food analyses were carried out in several Latin American countries. The Food and Agriculture Organization (FAO) sponsored compilation of a regional food

table for Latin America by the Institute of Nutrition of Central America and Panama (INCAP); the table was published in 1961 (1). Subsequently, FAO published food-composition tables for Asia in 1972 (2), for Africa in 1968 (3), and for the Middle East in 1970 (4), even though the available data for these areas were fewer and less reliable than those for Latin America. FAO then phased out its work on food composition and no new regional food-composition tables were published for 20–30 y except for one on the Near East that was published in 1982 by FAO (5). Subsequently, no regional tables appeared until 1994, when one for the Western Pacific was published (6). Of course, many national tables have been developed over the years.

A group concerned about the inadequacy of available food-composition data, especially in developing countries, met in January 1983 in Bellagio, Italy, in a conference organized by United Nations University (UNU) with participation by FAO and the World Health Organization (WHO). The purpose of this conference was “to explore the needs for, and current limitations of, food composition data bases. . . and to propose what was needed” (7). Out of this conference came the design and scope of the International Network of Food Data Systems (INFOODS). Its purpose would be to “promote international participation and cooperation in the acquisition and interchange of quality data on the nutrient composition of foods, beverages and their ingredients in forms appropriate to meet the needs of government agencies; nutrition scientists; health and agriculture professionals; policy makers and planners; food producers, processors, and retailers; [and] consumers (7).”

The 1983 conference identified the most important aspects of INFOODS as providing a network of regional data centers and an organizational and administrative framework for various expert task forces and serving as the generator and repository of special international databases, the stimulator of national database programs, and a general and specific resource for persons and organizations interested in food-composition data on a worldwide basis.

The executive summary of the conference report emphasized a series of specific recommendations to UNU that have been wholly or partly implemented to a remarkable degree, considering the limited resources that have been available (7). These recommendations are discussed below.

¹ From the Food and Nutrition Programme for Human and Social Development, United Nations University, Toyko.

² Address reprint requests to NS Scrimshaw, United Nations University, Box 500, Boston, MA 02114-0500. E-mail: unucpo@inf.unu.edu.

ESTABLISHMENT OF AN INTERNATIONAL SYSTEM

The first and most fundamental recommendation was to set up an international organization to be called INFOODS to provide leadership for the development of standards and guidelines for the collection, compilation, and reporting of food-component data with the aim of establishing and coordinating a worldwide network of regional data centers for the generation, compilation, and dissemination of accurate and complete information on food composition. These centers were expected to assist in the development of appropriate national databases.

UNU accepted responsibility for administering INFOODS and the project received support from the US National Cancer Institute for 3 y. INFOODS established a secretariat and developed the necessary software for storage of food-composition information and its interchange among databases. Until the end of 1993, the secretariat was based at Massachusetts Institute of Technology in Cambridge. Initially, William Rand served as executive secretary and John Klensin as principal research scientist. Since the beginning of 1994, the secretariat has been based at the New Zealand Institute for Crop and Food Research in Palmerston North and managed by Barbara Burlingame. With sponsorship from committees of the International Union of Nutritional Sciences (IUNS), the secretariat published four key documents.

The first, *Food Composition Data: A User's Perspective* (8), was based on a conference held in Logan, UT, in March 1985. The publication presents the views and experiences of prominent workers in the field concerning the importance of food-composition data, current problems with that information, and what must be done to improve the situation. It provides an essential introduction and survey for anyone interested in or expecting to be involved in gathering, compiling, and using food-composition data. The book emphasizes the ways in which such information underpins research and policy in important areas of public health, dietetics, nutrition, and epidemiology and is critical to the food industry and decisions made by bilateral and international assistance agencies. It is a useful reference for university courses on food and nutrition.

The second publication is *Compiling Data for Food Composition Data Bases* (9). Food-composition data have been compiled into many databases throughout the world. As uses for the data increase, more individuals and organizations become involved in their compilation, and the need for guidelines on data gathering, formatting, and documentation grows. This document describes recommendations for procedures used in compiling the values for food-composition databases. Specifically addressed are the following five principal ways to obtain information on the nutrient content of foods:

- 1) by direct analysis based on analytic measurements,
- 2) by calculation as representative values (eg, weighted means of several samples),
- 3) by collection from other sources (eg, from other tables or the literature),
- 4) by estimation from similar foods (eg, substitution of data), and
- 5) by estimation from ingredients (eg, recipe calculations).

The third publication, *Identification of Food Components for Data Interchange* (10), addresses the need for precise identification of the nutrients and other food components actually measured in gathering food-composition data. Common names for food components are often applied to a variety of methods

of analysis or to combinations of chemicals and this can result in different quantitative values for the same food. This book provides the first comprehensive standardization of nomenclature for the international exchange of nutrient data. It sets out a straightforward set of rules for identifying food components precisely and constructing databases suitable for transfer between computers.

The fourth publication, *INFOODS Food Composition Data Interchange Handbook* (11), provides information and guidelines pertaining to requirements for food-composition data, identification of nutrient and nonnutrient components of foods, computerized representation and accurate interchange of food-composition information, and the organization, compilation, and content of food-composition tables and databases. The book presents the structure and rules for moving data files between countries and regional organizations in a way that preserves all the information available. This approach alerts developers of databases to areas in which ambiguities are likely to exist and in which special care is required to identify ways to improve the overall quality of databases.

Interchangeability and accessibility of the INFOODS system data in developing countries depend on the universal use of these specifications. They are flexible and allow any number of additional nutrient tags and qualifiers to be added. Their adoption for databases in industrialized countries will greatly facilitate the global interchange of food-composition data.

ESTABLISHMENT OF AN INTERNATIONAL JOURNAL OF FOOD COMPOSITION

Those attending the Bellagio meeting also urged investigation of the "feasibility of establishing an international journal devoted to food composition studies." It was thought that such a journal "would facilitate adoption of guidelines by the scientific community, serve as an information source for any future revision of the guidelines, and would provide a means for dissemination of findings and critical reviews in all areas of food composition." In 1987 UNU established the *Journal of Food Composition and Analysis* in a copublication venture with Academic Press. With the agreement of Academic Press, UNU appointed Kent Stewart to be the journal's editor.

DIRECTORY OF EXISTING FOOD-COMPOSITION DATABASES

The group at Bellagio also recommended that a "global survey of existing data bases and of ongoing and planned data collection efforts" be compiled. This has been accomplished, and the list is available on the Internet (<http://www.crop.cri.nz/foodinfo/infoods/infoods.htm>). Paper copies can be obtained at cost on request to the secretariat (Barbara Burlingame, New Zealand Institute for Crop and Food Research, Private Bag 11030, Palmerston North, New Zealand; fax: 646-351-7050; e-mail: burlingameb@crop.cri.nz).

RECOMMENDATIONS FOR THE CONSTRUCTION AND USE OF FOOD-COMPOSITION DATABASES

Another proposal from the Bellagio meeting was that the entire area of data gathering be examined, with special attention paid to sampling, assay, and quality control. It was con-



cluded that two important aspects of this activity should be assessment of the problems involved in evaluating data in the literature and other sources and establishment of criteria for accepting data into a food-composition database. To facilitate implementation of these recommendations, UNU provided support for Heather Greenfield to spend a sabbatical year in Norwich, United Kingdom, working with David Southgate to write *Food Composition Data: Production, Management and Use*, which was published in 1992 (12). This volume systematically and authoritatively covers initiation and organization of a food-composition data program, selection of foods and nutrients (including sampling), choosing analytic methods, quality control, conventions and modes of expression of data, and guidelines for use of data. It is an essential companion to the INFOODS manuals described earlier.

SYSTEM OF NOMENCLATURE AND CODING

The Bellagio group also recommended "establishing nomenclature and a system of coding. . . [that] will include defining and recommending terms for identifying foods. . . and identifying components, units of expression, analytical methods, preferences, locations, environmental conditions, and others as necessary." To address this recommendation, a UNU-IUNS Committee chaired by Stewart Truswell developed a document that was published as *INFOODS Guidelines for Describing Foods: A Systematic Approach to Describing Foods to Facilitate International Exchange of Food Composition Data* (13). This report is based on extensive international consultations and is intended to be culture independent. It reviews the INFOODS guidelines for describing foods with the goal of facilitating interchange of food-composition data between nations and cultures by groups involved in compiling nutrient databases. Familiarity with the INFOODS system for describing foods is also useful in other areas of nutrition research, eg, in recording food intakes. The system is a broad, multifaceted, and open-ended description mechanism that uses a string of descriptors. Criteria are proposed for deciding whether a food is "single" or "mixed" (multi-ingredient) and different sets of descriptive facets are provided for the two classes of foods. Because of the complexity of food description when many different languages and cultures are involved, these guidelines are currently being reexamined by a new IUNS-INFOODS committee chaired by Stewart Truswell.

Since its inception, the INFOODS system has had the capacity to incorporate Languag codes as well as other national food-coding systems. However, a joint INFOODS-EUROFOODS investigation strongly suggested that the level of classification provided for by Languag is much more complex than most developing countries need, even though it may be useful in some industrialized nations. Another new IUNS-INFOODS committee, chaired by Gary Beecher, is working to develop quality codes to be attached to all entries in food-composition databases.

ESTABLISHMENT OF REGIONAL INFOODS DATABASES

Soon after the Bellagio meeting, initial organizational meetings were held for EUROFOODS (14), LATINFOODS (15), ASIAFOODS (16), and OCEANIAFOODS (17). By the time

of the second meeting of LATINFOODS in 1988 many Latin American countries had formed their own food-composition committees, with the most active of these being CHILEFOODS, ARGENTINAFOODS, BRAZILFOODS, VENEZUELAFOODS, and BOLIVIAFOODS. At the 1988 meeting, Ricardo Bressani, chairman of LATINFOODS, presented a standard form for recording sample information and analytic data that all the national committees agreed to follow. He also initiated an exchange of comparison food samples for quality control. Subsequent meetings of LATINFOODS were held in 1990, 1991, and 1995.

At its second meeting, ASIAFOODS decided to limit participation to the ASEAN (Association of Southeast Asian Nations) countries plus Laos, Cambodia, Vietnam, and Myanmar. Locally initiated activities of this network include the following:

- 1) Development of sampling guidelines for food composition. This activity is chaired by the national tables coordinator of The Philippines, Aida Aguinaldo. ASEAN food-sampling guidelines for the development of food-composition tables will be formulated and distributed to the national coordinators for comment. The final draft of these guidelines will be published and distributed to the member countries.
- 2) Documentation of analytic methods used in ASEAN. This activity is chaired by the national coordinator for Malaysia, Tee E Siong.
- 3) Collaborative testing for quality control of food-analysis laboratories. Evaluation of ASEANFOODS laboratories is the responsibility of the national coordinator for Thailand, Prapasri Puwastien. Currently, two food samples—soybean flour and rice flour—are available for laboratory proficiency tests.
- 4) Preparation of an operating manual and updating of the ASEANFOODS food-composition database and interchange system. An operating manual based on recommended INFOODS procedures has already been adopted.

In 1992 INFOODS received funding from UNU for the purchase of hardware and the support of training in the use of appropriate software for the regional databases of ASEANFOODS, located at the Institute of Nutrition of Mahidol University in Bangkok, and of OCEANIAFOODS, in Fiji (with the sponsorship of the South Pacific Commission). In 1993 a similar grant from the Canadian International Development Research Center allowed establishment of subregional databases for LATINFOODS at INCAP and the Institute of Nutrition and Food Technology at the University of Chile.

The first organizational meeting for AFROFOODS was held in Harare in 1988. The follow-up meeting was delayed because of limited resources but, with support from the Canadian International Development Research Center, was eventually held in 1994. At that meeting, an INFOODS structure for Africa was developed. The 18 Anglophone countries in East Africa will be part of ECSAFOODS, with a subregional center at the University of Zimbabwe. The five English-speaking countries in West Africa will make up WAFOODS, with a subregional data center at the University of Accra, Ghana. Senegal was proposed as the regional database site for the 23 Francophone countries. EUROFOODS includes the countries of Eastern Europe and the former Soviet Union; Australia and New Zealand are part of ASIAFOODS.



An important development for all food-data systems was the acceptance in 1994 of the INFOODS system of nutrient tags by the US Department of Agriculture (USDA), which maintains the largest food-composition database in the world, and by the International Food Data Association (IFDA). The IFDA provides a depository of information on the composition of foods marketed by the principal multinational food distributors. A consortium sponsored by the USDA and including IFDA will maintain the food-data center for NORAMFOODS. This organization, which initially involved only Canada, Mexico, and the United States, is expected to eventually include the countries of the Caribbean.

FAO PARTICIPATION

The most important development for INFOODS since the Bellagio meeting was the decision by FAO in 1993 to renew its interest in improving the food-analysis capacity of developing countries and assist in the production of updated regional food-composition tables. In March 1993 John Lupien, the new Director of FAO's Nutrition Division, convened a consultation session to discuss cooperation with UNU in addressing the food-analysis and food-composition database needs of 13 developing countries. This led to a more comprehensive meeting in 1994 at which the INFOODS system was endorsed and additional regional developments were planned. FAO will emphasize training and institution building for analytic capacity, whereas UNU and FAO will jointly promote the development of the INFOODS global network of regional data centers and regional food-composition tables. Each regional or subregional center will have the capacity to publish a food-composition table and maintain an electronic database.

The challenge ahead is to complete the global INFOODS network so that users in every country have access to the best available food-composition information relevant to their needs. The Institute of Nutrition in Beijing, China, has volunteered to establish a regional data center that would include information from Taiwan and the Koreas. The Institute of Nutrition in Tunis, Tunisia, is planning an organizational meeting for NAFOODS, which will include the five countries of North Africa. American University in Beirut will convene a meeting of representatives from the Arab countries of North Africa to establish ARABFOODS. GULFOODS will cover the Arab countries in the Persian Gulf. SAARCFOODS is being planned to include the nine other countries in southern Asia.

The ultimate goal of INFOODS is to have every developing country in the world associated with a regional database that can supply it with food-composition data and assist in the development of national databases adapted for various uses. INFOODS has been strongly advised that the promotion of a consolidated world database in a central location is technically unwise and unnecessary, as well as politically inappropriate. Instead, any location will be able to access and retrieve information from any INFOODS regional database and, by means of the interchange format developed by John Klensin, exchange data with any other computerized food-composition database.

The regional INFOODS centers are expected to provide compilers of national food-composition databases and tables with the best information available. Institutions and individuals can already request information from the INFOODS secretariat

in New Zealand by e-mail and from the regional data centers that are fully operational. The e-mail address for the INFOODS coordinator, Barbara Burlingame, is burlingameb@crop.cri.nz. The food-composition electronic discussion group is at food-comp@infoods.unu.edu. This is a subscription-only group, but anyone can be added to the list by sending e-mail to food-comp-request@infoods.unu.edu and putting his or her name on the subject line or as the message. Persons involved in the development of the international component-identifier (tagname) list are invited to participate on-line at food-tags@infoods.unu.edu. INFOODS information, including newsletters and directories of international food-composition databases, tables, and tagnames, is available on the World Wide Web (<http://www.crop.cri.nz/foodinfo/infoods/infoods.htm>). It is important to remember, however, that although establishing a fully functioning network for data exchange will help to identify gaps and errors in food-composition data, there remains an urgent need for institutional support of the creation—with modern methods—of new food-composition information on a larger range of nutrients and foods. □

REFERENCES

1. Wu Leung WT, Flores M. INCAP-ICNND food composition table for use in Latin America. Bethesda, MD: Institute of Nutrition of Central America and Panama, 1961.
2. Wu Leung WT, Butrum RR, Chang FH, Rao MN, Polacchi W. Food composition tables for use in East Asia. Rome: FAO, 1972.
3. Wu Leung WT. Food composition tables for use in Africa. Rome: FAO, 1968.
4. Pellett PL, Shadarevian S. Food composition tables for use in the Middle East. Beirut, Lebanon: American University of Beirut, 1970.
5. Food and Agriculture Organization. Food composition tables for the Near East. Rome: FAO, 1982.
6. Dignan CA, Burlingame BA, Arthur JM, Quigley RJ, Milligan GC. The Pacific Islands food composition tables. Palmerston North, New Zealand: New Zealand Institute for Crop and Food Research, 1994.
7. Rand WM, VR Young. Report of a planning conference concerning an international network of food data systems (INFOODS). *Am J Clin Nutr* 1984;39:144-51.
8. Rand WM, Windham CT, Wyse BW, Young VR, eds. Food composition data: a user's perspective. Tokyo: United Nations University, 1987.
9. Rand WM, Pennington JAT, Murphy SP, Klensin JC. Compiling data for food composition data bases. Tokyo: United Nations University, 1991.
10. Klensin JC, Feskanich D, Lin V, Truswell AS, Southgate DAT. Identification of food components for data interchange. Tokyo: United Nations University, 1989.
11. Klensin JC. INFOODS food composition data interchange handbook. Tokyo: United Nations University, 1992.
12. Greenfield H, Southgate DAT. Food composition data: production, management and use. London: Elsevier, 1992.
13. Truswell AS, Bateson DJ, Madafoglio KC, Pennington JAT, Rand WM, Klensin JC. INFOODS guidelines for describing foods: a systematic approach to describing foods to facilitate international exchange of food composition data. *J Food Comp Anal* 1991;4:18-38.
14. West CE. EUROFOODS: toward compatibility of nutrient data banks in Europe. *Ann Nutr Metab* 1985;29(suppl 1):1-72.
15. Bressani R. Memorias de la primera reunión sobre tablas de composición de alimentos LATINFOODS. (Account of the first meeting on LATINFOODS food composition tables.) *Arch Latinoam Nutr* 1987;37:607-26.
16. Rand WM, Stuckey A, Valyasevi A, Tontisirin K. Proceedings of the First ASIAFOODS Conference. Bangkok, Thailand: Prayurawong, 1985.
17. English R, Lester IH, eds. Proceedings of the First OCEANIAFOODS Conference. Canberra, Australia: Australian Government Publications House, 1987.

