Simopoulos AP, Butrum RR (eds): International Food Data Bases and Information Exchange. World Rev Nutr Diet. Basel, Karger, 1992, vol 68, pp 121–135

Past and Present Activities in Food Composition Tables in Latin America and the Caribbean Islands

Ricardo Bressani, Marina Flores

Division of Food Science and Agriculture, INCAP, Guatemala City, Guatemala

Contents

Introduction

Before regional or national food composition tables existed, the Food and Agriculture Organization (FAO) of the United Nations published food composition tables in 1949 and 1954 for international use, based on analytical data from different parts of the world [1, 2]. These tables were intended to be used in countries that had no food composition data and to compare the nutrient content of food supplies in the different countries for the development of Food Balance Sheets. Recently, the important association between nutrient intake and disease as well as different consumption patterns among regions requires more detailed national food composition tables.

Any nutrition-related project requires the study of the dietary aspects of the subjects or population groups, where foods consumed are converted

into values of nutrients from food composition tables. However, because of the great variability of the nutrient content and bioavailability in raw, processed, and cooked foods, it is critical to know whether the values are appropriate for the study. Food composition tables have been prepared by different authorities who each adopt different criteria for the methodologies and treatment of food samples according to the techniques practiced in their laboratories. Therefore, it is necessary and extremely important to study the introductory text and explanation notes given in these tables to document sources and determine the procedures followed in the compilation of the data.

The most extended use of food composition tables is the evaluation of the food patterns of people from different cultures or regions. National tables are likely to have the most reliable values for the foods in a given country. However, differences in the chemical composition of the same food among neighboring countries are often not important: especially if allowances are made for variation in water content. Consequently, food composition data compiled regionally may be satisfactory. Discussed below is the development of national Latin American and the Caribbean Islands food composition tables, their status, and future prospects.

Historical Perspectives Related to Food Composition Tables in Latin America

Before 1940, scientists working in university laboratories and the National Nutrition Institutes in Latin America began researching the chemical composition of foods. In Chile and Argentina, well-known nutritionists focused their studies on the nutritive value of regional foods and published their results in the first National Food Composition Tables. The first edition of the Chilean tables was published in 1961, with 112 food items [3]. The second edition was printed in 1965 and included 133 food items. After a series of updated tables, the sixth edition was published in 1979 and included 379 food items. Since then, complementary publications on various aspects of food composition have been published, including a 1945 publication from Argentina [4]. In 1954, the first Food Composition Table for Brazil was published, and emphasized the vitamin content of Brazilian foods [5]. Updates of this table were published in 1974 and 1982.

In 1965, analytical chemists from the Ecuadorian National Nutrition Institute in collaboration with biochemists from the Massachusetts Insti-

tute of Technology (MIT) prepared the first composition table of Ecuadorian foods [6]. Although some nutrient data on Mexican foods were published before 1940, the National Institute of Nutrition in Mexico collaborated with MIT to initiate a systematic analysis of the nutrient content of Mexican foods and published the table in 1951. The Colombian National Institute of Nutrition was founded in 1944, and one of its first focuses was the analytical study of foods. This work formed the basis for the Food Composition Tables for Colombia [7]. In Venezuela, the biochemical laboratories of the National Nutrition Institute dedicated their initial efforts to analyses of local foods, which led to the development of the first Venezuelan food composition table [8].

In Peru, seven documents were published from 1950 to 1975 on the nutrient content of the more commonly consumed Peruvian foods. Other documents include a table on fatty acid content, minerals, and indigenous foods consumed by rural inhabitants and minority groups [9]. Similar activities have been conducted in Bolivia [10].

Since 1952, nutrition researchers in Cuba have been very active in studying the edible flora and fauna of the country and compiling nutrient analyses of their foods. Local scientists in food science and nutrition in collaboration with food scientists from MIT presented their results in three different publications. In 1955, 115 samples of vegetable foods were analyzed; in 1957, results from analyses of 137 other vegetable foods were published, and in 1963 , 106 samples of foods collected in different parts of the island were analyzed [11–13].

English-speaking countries of the Caribbean Islands have developed food composition tables from data analyzed and compiled in the United States (US), FAO tables, and analytical values from the laboratories of the Jamaica Nutrition Institute [14].

Vegetable foods from the Central American area that includes Guatemala, Honduras, El Salvador, Nicaragua, and Costa Rica were the subject of an extensive and careful cooperation food analysis project between the laboratories of MIT and the United Fruit Company. Coordinated by MIT, the research team included a botanist who identified and classified plants and local chemists who analyzed plants from different localities of the Central American countries from 1944 to 1946. Their findings were presented in a series of publications in the *Journal of Food Research* of the USA in 1949 and 1950 [15]. Food sample collection methods from different farms and markets in the area and details concerning the analytical methods used in the MIT laboratories were described in the reports. To

facilitate the identification of vegetable foods, information on plant part, size, color, and maturity was provided. Local cooking practices were also described.

The information, produced at MIT, was presented to the Instituto de Nutrición de Centro América y Panamá (INCAP) to provide a framework for analysis of foods and dietary studies in Central America. Since this presentation, food consumption studies have continued in Central American countries to assess the nutritive value of the inhabitants' dietary patterns. In the process, many other food items, including animal foods, were identified and analyzed by INCAP. In 1952, nutritionists and food scientists at INCAP began research on food habits of rural and urban populations in Central America and on the effects of indigenous food processing on nutrient composition of commonly consumed foods. With the analytical information available in 1953, the first Composition Table for Central America was published [16]. Most of the figures presented in the tables are averages of several samples of the same foods produced in different localities. Values that deviated greatly from the averages were not included. Carbohydrate values were calculated by difference, and specific factors were applied to obtain total calories for each food. The calorie and nitrogen conversion factors for protein were adopted from figures provided by the United States Department of Agriculture (USDA) [17], taking into account the digestibility of the foods [18].

During 1950–1960, INCAP conducted a dietary survey using 7-day dietary records. This information provided valuable data on edible portions of foods. Many of the national food composition tables, as well as regional tables, express nutrient values in terms of the edible portion per 100 g. The FAO international food composition tables present the values in terms of the edible portion and include the gross or as purchased weight of the foods. The edible portion of foods is obtained at the laboratories by applying correction factors based on the proportion of refuse and water content.

Results of food consumption studies carried out from 1950 to 1965 in Central and South America helped to identify foods needing analysis. At the end of this period, most of the Latin American countries published their own national food composition tables. Food analyses at the chemical laboratories of INCAP and others included special studies on processed and native foods such as corn tortillas, bread, different kinds of cheese, and many typical dishes. Analyses were also conducted on the basic staple foods such as maize, beans, and sorghum. With all the data from MIT and

INCAP, a new food composition table was prepared for the Central American countries in 1960 [19]. This table included the common and scientific name of each item, percentage of discarded part, water content, calories, and protein, fat, carbohydrates, fiber, ash, calcium, phosphorus, iron, vitamin A activity, thiamine, riboflavin, niacin, and ascorbic acid content in 100 g of edible portion. The acceptability of and great demand for this table was because of its attractiveness, clear presentation, the classification of nutrient data according to the food groups, and inclusion of nutritive values for local foods for each country.

State of Food Composition Tables

As discussed above, most of the available food composition tables were developed in the early 1940s. The Latin American food composition table, published in 1961, contains 716 food items [20]. The number of food items in the Latin American tables varies from 155 in El Salvador [21] to 1,648 in Argentina (table 1). Table 2 provides information on the nutrients

Table 1. Food composition tables in Latin America

Country	Date of first edition	Number of food items[1]
Central America	1960	314 (1971)
Latin America	1961	716 (1961)
Argentina	1935–1942	1,648 (1945)
Bolivia	1966	645 (1984)
Brazil	1954	–
Caribbean (English)	1974	799 (1986)
Colombia	1944	294 (1978)
Chile	1961	378 (1985)
Dominican Republic	1964	572 (1985)
Ecuador	1954	586 (1965)
Mexico	1940	391 (1983)
Peru	1960	460 (1975)
Uruguay	1949	53 (1949)
Venezuela	1950	484 (1983)
El Salvador	1989	155 (1989)
Cuba	–	238 (1985)

[1] In last edition.

Table 2. Information on food composition available in Latin American food composition tables (table from country or region)

Component	Latin America	Argentina	Bolivia	Caribbean	Central America	Chile	Colombia	Cuba	Dominican Republic	Ecuador	El Salvador	Mexico	Peru	Uruguay	Venezuela
Proximate composition	yes	yes*	yes	yes*	yes	yes	yes	yes*	yes	yes	yes	yes	yes	yes	yes
Energy	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Calcium	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	–	yes	yes	yes	yes
Iron	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	–	yes	yes	yes	yes
Phosphorus	yes	yes	yes	–	yes	yes	yes	yes	–	yes	yes*	–	yes	–	yes
Sodium	–	yes	yes	yes	–	yes	–	–	–	–	–	–	yes*	–	yes*
Potassium	–	yes	yes	yes	–	yes	–	–	–	–	–		yes*		yes
Zinc	–	–	–	yes	–	yes	–	–	–	–	–		yes		
Trace elements	–	yes	–	–	–	yes	–	–	–	–	–		yes		
Carotene	–	yes	–	–	–	–	–	–	–	yes	–		yes		
Vitamin A	yes	yes	yes	yes	yes	yes	yes	yes	yes	–	–	yes	no		yes
Vitamin B_1	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	–	yes	yes		yes
Vitamin B_2	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	–	yes	yes		yes
Niacin	yes	yes	yes	yes	yes	yes	yes	–	yes	yes	–	yes	yes		yes
Folic acid	–	–	–	yes	–	–	–	–	–	–	–		no		
Vitamin B_{12}	–	–	–	yes	–	–	–	–	–	–	–		no		
Vitamin B_6	–	–	–	–	–	–	–	–	–	–	–		no		
Vitamin C	yes	yes	–	yes	yes	yes	yes	yes	yes	yes	yes*	yes	yes		yes
Fatty acid	–	–	–	yes	–	yes	–	–	–	–	–		yes		
Amino acids	–	–	–	essential	–	yes	–	–	–	–	–	yes	some		
Cholesterol	–	yes	–	yes	–	–	–	–	–	–	–		no		
Cellulose	–	yes	–	–	–	–	–	–	–	–	–		no	yes	
Oxalic acid	–	some	–	–	–	–	–	–	–	–	–		no		
Purinas and uric acid	–	some	–	–	–	–	–	–	–	–	–		no		
Fluoride	–	–	–	–	–	yes	–	–	–	–	–		yes		
HCN	–	–	–	–	–	yes*	–	–	–	–	–				
Observation		*No ash		*No ash		*Beans		*No ash			*Fruits and vegetables		*Special table		*Special table

that have been analyzed for foods listed in the available food data tables [4, 6, 8, 10, 19, 22–41]. Some tables contain less common analytical information, including purines and uric acid, possibly because of the high intake of animal products in that region.

The types of food items vary from table to table, particularly those foods that are inherent to a particular country. Most tables follow the same food groupings: cereal and cereal products, vegetables, fruits, dry food legumes and their products, almonds and nuts, dried seeds, sugars and syrups, meats and fowl, eggs, fish and shellfish, milk and dairy products, fats and oils, beverages, and miscellaneous foods. Some include mixed dishes and special food items. Nutrient data include moisture content, protein, fat, crude fiber, ash, carbohydrate, calories, calcium, phosphorus, iron, thiamine, riboflavin, niacin, vitamin A, carotenes, and vitamin C. Only a few tables have information on trace elements or amino acid and fatty acid content. A recent table from Chile, however, has very complete data on fatty acids for animal, fish, and vegetable oils [24]. Various countries have published a table on the content of sodium and potassium in foods [25]. Some of the analytical methodologies used to produce these data are old, but efforts are being made to update the methodology in a number of countries.

It should be noted that most information comes mainly from nutrition institutes. Data exist from a number of university laboratories and/or quality-control laboratories, but efforts have not been made to incorporate those data into the existing data base. For example, although the carotenoid composition of Brazilian foods is available in a number of publications [26], it cannot be found in the food composition tables. This area requires more attention if Latin American data bases are to be updated and improved.

Updating and Other Needs

Over the past 25 years in Latin America, significant changes in analytical methodologies and agricultural technology have taken place [27], and food composition tables must be updated to represent these advances. Examples of these technological advances include the production of hybrids for maize and the intensive use of compounded and medicated feeds for animal products. Agricultural practices now include greater use of chemical fertilizers to control weeds and plant diseases. Similarly, there

has been a steady increase in processed food products that use new techniques that may affect the nutrient content of foods. Lime-treated maize tortillas or arepas were mainly a home process some 25–30 years ago, but today tortillas are made from processed maize flour and sold packaged in the supèrmarket. In addition, beans are being used in other products such as cooked bean flours, canned whole beans, or canned bean paste. The same tendency has taken place with animal food products.

In Latin America, the migration to urban centers has led to the adaptation of new lifestyles and dietary habits. People have a greater choice of ready-to-eat foods or fast-foods for which no analytical values are available. In urban centers, an increasing number of street food vendors sell many types of foods, most of which have not been analyzed. Although processed foods are packaged in different types of materials, information related to changes in food composition upon storage is not available. In summary, many factors must be considered as efforts to update food tables are initiated.

First, a system designed to select and incorporate new analytical data into an existing data base needs to be developed. Standards for coding and describing food data should be included in light of the large number of different food items found in the various regions of Latin America. This system should include standardized sample collection methods, supporting data for sample identification, descriptions of processes – mainly those of autochthonous origin, improved and accepted analytical techniques, reference standards, and reporting method.

Updating the quality of present food composition tables also depends on the needs of the users. Although vitamin A deficiency is quite common among population groups in Latin America, the information available on carotenoid content in vegetable products is poor [26]. The deficiency problem should be solved by a greater consumption of food sources rich in carotenes; however, because of the lack of data. the problem is being solved through fortification programs. Iron deficiency is another problem, yet little attention has been given to the validity of the iron values in the tables. With present changes in dietary habits, including diets of low fiber content, attention should be given to dietary fiber content in the main foodstuffs consumed by the population. Although many people base their diet on root and tubers, carbohydrate content is still being obtained by difference as opposed to analysis. Furthermore, data has been produced in various laboratories, but no efforts have been made to retrieve them, select them, and incorporate them in data bases. Efforts to update and improve

these tables must be organized and approached systematically. One organization that has played an important role in this area is LATINFOODS.

LATINFOODS

In November 1986, the First Conference on Food Composition was held at INCAP, sponsored by the International Development Research Centre (IDRC), the United Nations University (UNU), and the US Agency for International Development (AID). The main objectives of the meeting were: (1) to review the state of knowledge of food composition tables for the individual countries and for the region; (2) to propose programs aimed at increasing the usefulness of and upgrading present tables in terms of quantity and quality of analytical data, and (3) to develop a network of people and institutions interested in food composition tables through the development of LATINFOODS [28].

At this conference, several reports were presented on the historical perspectives and compilation of available food composition data and the country's need for new data [7, 14, 29–41]. These reports strongly indicated that data are available and should be obtained, selected, and incorporated into data bases. To reach the second objective, conclusions and recommendations were requested from three groups: users of food composition data; compilers of food composition values, and data producers. The users working group indicated that present tables were incomplete because they did not contain information on many indigenous foods or on new foods from the food industry. They recommended that international programs donate food composition data. Because most values are given for raw foods, the need for nutrient values for foods as they are commonly consumed was emphasized. With respect to nutrients, iron and vitamin A values received some priority, indicating that present values are inconsistent and incomplete. Other nutrients include sodium and potassium values as well as zinc and iodine, fatty acids, dietary fiber and specific carbohydrates. Many participants expressed interest in citing values for polyphenolic compounds, oxalates, and phytates. The data producers working group reinforced the recommendations of the users group, which included the need for updated equipment and training and guidelines for sampling and selection of data. In addition, the need for collaborative studies and increased communication and interchange of information was discussed.

The data compilers agreed on the need for development of guidelines for data selection and appropriate reporting as well as strong collaboration with those producing and using food composition data.

There was agreement among the three groups to create and implement LATINFOODS. The first step in this process was to recover available data and develop a set of criteria for data selection. The criteria should constitute a shared data base that could serve as a basis for developing specific tables for local needs. Close collaboration and communication between data users and producers would be necessary to accomplish these steps.

National groups were created, consisting of representatives from various institutions and disciplines. The center of the network would be located at INCAP, with a committee consisting of a coordinator, four subregional representatives from Mexico, Venezuela, Brazil, and Chile, and the president of the Latin American Society of Nutrition.

Present objectives of LATINFOODS include identifying sources of food composition data, developing quality criteria for selection of data; promoting data generation; acquiring and disseminating new analytical data; facilitating the access, production, and interchange of data; and developing activities that will keep the concept alive.

Achievements and Prospects

Although funding issues have not been resolved, LATINFOODS has had numerous achievements since 1986. Eight national groups have been established in Argentina, Brazil, Chile, Bolivia, Ecuador, Venezuela, Costa Rica, and Nicaragua. Despite economic limitations, these groups hold regular meetings and submit proposals to the Coordinator General that are related to initiating specific regional activities.

With the help of the International Program in the Chemical Science (IPICS) and the Chemistry Center of the University of Lund, Sweden, a short course on dietary fiber analysis was conducted at INCAP in February 1988 and attended by 16 participants from Mexico, Central America, Colombia, and Ecuador. From this analytical course, arrangements have been made for a collaborative study supported by IPICS on dietary fiber analysis. Its success will contribute significantly to the future development of LATINFOODS.

A small grant administered by the LATINFOODS headquarters was provided to three national groups in Central America to produce new data on foods selected by the national groups. From this small effort, a table of food data from El Salvador has been published [21], and one from Costa Rica will soon become available. In addition, a form for compiling data accompanied by an instruction book for collection of information was developed at INCAP. These forms provide space for a detailed description of individual food and raw or processed food composites.

A second LATINFOODS meeting was held in November 1988 in Chile where various speakers discussed current analytical methodology in Latin America. Present capabilities include fatty acid analysis, mineral analysis, and dietary fiber analysis. However, analytical methods for vitamins, carotene, and carbohydrate still need improvement. Strategies for obtaining necessary funding for and conducting collaborative studies throughout Latin America were also discussed.

The concept of LATINFOODS was presented at the VIth Latin American Meeting in Food Science and Technology, October 1988, in Bogota, Colombia, and at the VIIth Latin American Nutrition Congress, November 1988, in Viña del Mar, Chile. These presentations emphasized the importance and significance of LATINFOODS and increased the number of contributions to the concept. In addition to a LATINFOODS newsletter, a section on food composition in the journal *Archivos Latinoamericanos de Nutrición*, has been established. These provide new information related to dietary fiber content of cereal grains, food legumes, and vegetables, fatty acid content of various oils, trace mineral content of processed basic staple foods, and carotene content of local fruits such as pejibaye and native vegetable crops.

Early in 1990, a third meeting of LATINFOODS was held in San Jose, Costa Rica. Highlights of the conference included uses of food composition data by the food industry, needs for food labeling data, the effects of processing on composition, and the use of computers in the development of data bases.

Latin American food composition tables were originally developed to interpret nutrition surveys. Although nutritional deficiency problems still prevail in many Latin American countries, problems because of nutrition-related diseases such as cancer and cardiovascular disease are increasing. Food composition tables must be updated to reflect these new concerns. Food and nutrition surveillance activities can be a useful approach for the collection and analysis of new data to enrich present tables. Many nutri-

tion intervention studies need updated nutrient intake data to measure the variables. New multidisciplinary research teams throughout Latin America are becoming active again because of technological advances, including new equipment, and the use of computer programs. Other activities that are fostering interest in developing food data bases include new nutritional evaluation concepts such as chemical scores for protein that are based on essential amino acid content and digestibility, the presence of foods or ingredients in canned foods for which no analytical values are available such as the oil in canned fish, food products derived from new processing technologies, food labeling, and food fortification. LATINFOODS plays an important role in the renewed interest in food composition data.

Conclusion

This communication reviews the past, present, and future of food composition tables in Latin America and the Caribbean Islands. Food composition tables were originally constructed from analytical values obtained during 1940–1960. The participation of food and nutrition scientists from MIT was essential for the development of tables from Mexico, Cuba, Central America, and Ecuador. In addition, national scientists were responsible for tables developed in Venezuela, Chile, and Argentina.

The identification and collection of data from food items not available in existing food composition tables was first made possible by nutrition surveys that defined dietary patterns, nutrient intake, and nutrient deficiencies. The first attempt to integrate available data from nutrition institutes can be traced to the development of food composition tables for use in Latin America. The nutrients listed include energy, proximate composition, and limited number of macro- and micronutrients. Some tables contain data on sodium, potassium, fatty acids, and amino acids. Not all data are original to each country table; many values are obtained from other tables, including those from the US or FAO.

Because of changes in analytical techniques, agricultural and processing technology, dietary habits, and the lack of standardization among food composition tables, LATINFOODS was created in 1986 to maintain and update food composition data in Latin America and the Caribbean Islands. In the future, LATINFOODS will continue to have a major role in creating more representative and useful food composition tables.

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Ricardo Bressani, PhD, Institute of Nutrition of Central America and Panama, Carretera Roosevelt, Guatemala City 01011 (Guatemala)