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Report

Development of SICA-COR, a food composition information system for Costa Rica

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ABSTRACT

The Costa Rican Food Composition Information System (SICA-COR) has been developed to address the increased demands for local food information by health workers, decision makers, food industry, international commerce, and consumers. It has a software application that allows updating and managing of information in a more versatile, cost-effective and accessible way than conventional food composition database systems. The purpose of this work is to present the development and current state of SICA-COR. The system was developed using four main steps, identification of available food composition data, sources and needs; data capture and quality evaluation; development of the SICA-COR software; and establishment of the database. SICA-COR has a validated, LATINFOODS-compatible information capture form which includes detailed descriptions of the data sources, food names, and quality parameters and allows for inclusion of data for more than 80 nutritional components per 100 g edible food. The software was developed using a Microsoft® SQL Server database engine and Java™. Of 1200 completed compilation forms, 83% fulfilled LATINFOODS standards and were incorporated into the database. Most of the data consists of values for energy, water, carbohydrate, fat, protein and ash. Predesigned reports are available for specific and general end users such as members of the LATINFOODS Regional Center. The current SICA-COR Version (0.9) is a stand-alone application intended to eventually evolve to a web application. Specific actions to test and improve the software are underway.

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1. Introduction

The Costa Rican branch (COSTA RICAFOODS) of the Latin American Network of Food Data Systems (LATINFOODS) was established after the First Conference on Food Composition Tables for Latin America and the Caribbean Islands held in Guatemala in 1986 (Bressani, 1987). At that meeting, it was concluded that the updating of food composition information throughout Latin America was urgent and required an organized and collaborative effort such as the initiative undertaken in 1993 by the International Network of Food Data Systems (INFOODS) (Scrimshaw, 1994).

In Costa Rica, a Food Composition Information System (SICA-COR) has been developed to provide access to reliable, representative and recent composition data for local foods, as well as to improve food analysis capabilities. After identifying the needs for information on food composition (Fernández-Piedra et al., 2000), strictly needed analyses were done on selected raw, processed and prepared local foods and disseminated through scientific publications and reports (Blanco, 1995, 1989; Blanco and Montero, 1992; Blanco et al., 1988, 2000, 2004, 2005; Fernández, 1988; Fernández et al., 1995; Montero et al., 1998; Tovar et al., 2005; Vargas et al., 1986). Because of the need to develop the SICA-COR application and limited support to develop the Internet software, the system relied on printed food composition tables as the best resources available to develop an updated, good-quality database containing data by direct analysis of local foods. The following four food composition tables specific for Costa Rica have been developed recently and are published, Macronutrients and Dietary Fibre (Blanco-Metzler et al., 2006), Micronutrients (Novygrodt-Vargas and Silva-Trejos, 2009), Fatty Acids (Monge-Rojas and Campos-Núñez, 2006), and Fortified Foods (Alfaro-Calvo et al., 2006).

Efforts to compile data and to develop instruments to collect, store, evaluate and disseminate data are underway. In 1998, COSTA RICAFOODS created "Programa de Rondas Interlaboratorio de Análisis de Alimentos, pridaa" (Proficiency Testing Program of Foods). The program is coordinated by the National Center of Science and Food Technology (CITA) of the University of Costa Rica and was developed based on the established guidelines (ISO/IEC, 1997; IUPAC/ISO/AOAC, 1993). Nutritional components currently being measured are energy, water, carbohydrate, fat, protein, ash, dietary fibre, sugars, iron, calcium, potassium, and sodium (CITA/UCR, 2007). The purpose of this paper is to describe the development and current state of SICA-COR, Version 0.9.

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2. Description of SICA-COR

SICA-COR was developed following four main steps, identification of available food composition data, sources and needs; data capture and quality evaluation; development of the SICA-COR software; and establishment of the database.

2.1. Identification of available food composition data, sources and needs

A survey of professionals involved with food composition data was completed in 1988. Twenty-one individuals in public institutes and 25 individuals in private organizations were contacted, and a 67% return rate was obtained. Informants included food technologists (38%), nutritionists (25%), chemists (20%) and others (17%). Results showed that 38% of the informants could be considered users of food composition data, while 62% were food composition data producers. Energy, water, carbohydrate, fat, protein and ash (47%) and physical measures (19%) were the more frequently laboratory analyses that were done. Micronutrient analyses were done only in 5% of the laboratories. The Methods of the Association of Official Analytical Chemists (AOAC, 1995) were the most commonly used. Food composition tables were used by 75% of informants for the following purposes: to compare chemical analyses results (20%), to develop nutrition labels (15%), to formulate and modify foods (14%) and for nutrition programs and education (12%). The most frequently used food composition tables (41%) were those developed by the Institute of Nutrition of Central America and Panama (INCAP) for the Latin American region (Wu Leung and Flores, 1961; Menchú et al., 1996). Eighteen percent of informants used the national food table published by the National Institute of Research in Health (INISA) of the University of Costa Rica (Murillo and Ulate, 1984), which included mainly data from INCAP's Food Composition Table (Wu Leung and Flores, 1961). Both the American (USA) and European countries food composition databases were used by 12% of the professionals. Food tables from other Latin American countries were used by less than 12%. Lack of information on local native, prepared and processed foods, and the smaller number of nutrients evaluated was identified as the main limitations of the food composition tables (Fernández-Piedra et al., 2000).

The need for food composition data is growing in Costa Rica as a result of new legislation requiring accurate nutrition labeling, e.g., nutritional and health claims for *trans* fatty acids and requirements for the exportation of foods to countries with more strict nutrition labeling. The priorities identified in the National Dietary Guidelines for nutritional components are those related to excess, deficiency or imbalance of nutrients (CIGACR, 2007). New fortification interventions for iron and folic acid have been implemented by the government. Other information, such as data for dietary fibre and selenium are very limited, and data for phytochemicals are almost nonexistent.

2.2. Data capture and quality evaluation

A predefined form for data collection was developed in 1996 by the data compilation committee of COSTA RICAFOODS. The original form had three sections to identify the data source, including complete bibliographic reference; capture the food name, processing methods, geographic origin and site of collection; and provide data for about 80 nutritional components per 100 g food as eaten, with detailed analytical methodology, including number of samples analyzed.

The source of the information was documented as fully as possible. Authorship was detailed by the complete publication reference or the information on data provider (name, phone and fax number, E-mail). Also, the laboratory (name and address) for the analyzed food, date and the person responsible were identified. For food identification, the INFOODS guidelines (Truswell et al., 1991) and LATINFOODS suggestions (FAO, 1995) were adopted. The form was prepared in Microsoft® Word and completed for each individual food item. This form was used up to 2006, when it was substituted by the LATINFOODS form, developed by BRASILFOODS (Menezes et al., 1997).

LATINFOODS used an updated form that is compatible with INFOODS tagnames for food components (Klensin et al., 1989) and food identification guidelines to facilitate data exchange (Truswell et al., 1991). A tagname corresponds to a code that identifies, unambiguously, a specific food component with a specific method of analysis and includes a unit of measure (Klensin et al., 1989; Menezes et al., 2002).

Because the LATINFOODS form was developed as a Microsoft® Excel document, automatic calculations and access to information for many food items belonging to a unique data source are possible. A SICA-COR version of the LATINFOODS form has been implemented for compatibility with the national database and for access to additional information such as local food codes, list of ingredients for prepared and processed food products and specific accredited nutrients.

Food name identification is detailed and includes the generic name; kind part, maturity, processing, food grade, edible part, scientific name and variety; English, alternative, and commercial names; ingredients list; and trademark. Photos of the foods with botanical parts identification and photos of food labels are also collected. Nutrients are identified on the form in detail with INFOODS tagnames. The nutrients include are energy, macronutrients, carbohydrates, amino acids, fatty acids, minerals, fat and water-soluble vitamins; all nutritional components are expressed per 100 g edible food. Quality parameters include the sampling plan, collection site, geographic origin, sample handling procedures, details of the analytical methods and analytical quality control.

At present, the criteria used to evaluate the quality of the data were defined in consensus with LATINFOODS members (FAO and LATINFOODS, 2004). The minimal required information for acceptance of the data is the common and/or scientific name of the food; the number of samples and sample origin; detailed analytical methodology with complete references; numeric values and analytical sources.

To date, the forms have been completed exclusively by the compilation committee. After a careful standardization of the process, it is expected that forms will be completed and sent via air mail to Costa Rican Institute of Research and Education in Nutrition and Health (INCIENSA) by most of the individuals and organizations that are sources of the food composition information.

2.3. Development of the SICA-COR software

The SICA-COR software (Version 0.9) was developed by the Technological Institute of Costa Rica (ITCR) and INCIENSA between 2005 and 2006 as part of a student's work in Computing Engineering and a local research project. The design was based on an existing form developed by COSTA RICAFOODS and updated for compatibility with the form developed by LATINFOODS.

The software consists of three architectural layers: a database layer created in Microsoft® Structured Query Language (SQL) Server, a business logic layer and a presentation layer. The latter two are implemented using Java™, Version 1.4. The database layer stores and centralizes all the data registered in the system. The business logic layer allows access to the data, plus the generation of reports, the security of the system and the communication between the database and the user. The presentation layer allows

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