

Report

USDA Food and Nutrient Database for Dietary Studies: Released on the web[☆]

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Received 15 February 2005; received in revised form 25 January 2006; accepted 4 February 2006

Abstract

The USDA Survey Nutrient Database and other technical files used to code foods and calculate nutrient values for national food consumption surveys were updated, redesigned, and renamed the USDA Food and Nutrient Database for Dietary Studies (FNDDS). This new database is now available over the internet from the Food Surveys Research Group (FSRG). Code numbers, food descriptions and food portion weights were added to accommodate the latest release of What We Eat in America, the dietary component of the National Health and Nutrition Examination Survey (NHANES). Food weights and portions were updated to reflect current fast food and other individually sized products. Nutrients were added and all nutrient values were updated based on the latest release of the USDA National Nutrient Database for Standard Reference. The FNDDS can be downloaded from the FSRG website (<http://www.ars.usda.gov/ba/bhnrc/fsrg>) in both ASCII and Microsoft Access[®] formats. It contains descriptions for 13,500 foods, complete data for energy and 62 other nutrients, and over 30,000 weights for common food portions. The database may be used in conjunction with dietary data from What We Eat in America/NHANES, or applied to other dietary studies to provide comparability with national data.

Published by Elsevier Inc.

Keywords: Food and nutrient database; Dietary studies; Food consumption surveys; Nutrient intake; Food intake; Food portion weights

1. Introduction

The United States Department of Agriculture (USDA) Food and Nutrient Database for Dietary Studies

Abbreviations: ARS, Agricultural Research Service; CNRG, Community Nutrition Research Group; CSFII, Continuing Survey of Food Intakes by Individuals; DHHS, US Department of Health and Human Services; EPA, US Environmental Protection Agency; FCID, Food Commodity Intake Database; FNDDS, USDA Food and Nutrient Database for Dietary Studies; FSRG, Food Surveys Research Group; NDL, Nutrient Data Laboratory; NHANES, National Health and Nutrition Examination Survey; PDS, Primary Data Set; OPP, Office of Pesticide Programs; SR, USDA National Nutrient Database for Standard Reference; USDA, US Department of Agriculture

[☆]Presented at the 28th National Nutrient Databank Conference, 23–26 June 2004, University of Iowa, Iowa City, Iowa. Some database details updated in January 2006.

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(FNDDS), a resource for the study of food consumption, is now available to researchers via the internet. This database provides comprehensive information for use in coding individual foods and portion sizes, as well as nutrient values for calculating nutrient intakes. Results from dietary research using this database have the potential for comparison with nationally representative data because the database is used for What We Eat in America, the dietary intake interview component of the National Health and Nutrition Examination Survey (NHANES). This paper describes the origin and features of the database, provides directions on how to obtain it, and discusses various ways it can be used in dietary research.

2. Origins of the FNDDS

USDA conducted the first national survey of food intakes by individuals in 1965–66 (Tippett et al., 1999).

Since that time, extensive electronic data files about foods (descriptive information, nutrient values, and weights for typical food portions) have been assembled by USDA to support additional surveys. They have been used to process thousands of dietary intake records, including those collected in the USDA Nationwide Food Consumption Surveys (NFCS) 1965–66, 1977–78, and 1987–88, and Continuing Surveys of Food Intakes by Individuals (CSFII) 1985–86, 1989–91, and 1994–96, 1998. Since 1988, they have also been used with the National Health and Nutrition Examination Survey (NHANES) 1988–1994, 1999–2000, 2001–2002, and 2003–2004 (US Department of Health and Human Services, 1994, 2002). Over the years, those files were updated and expanded to address the increasing requirements for national food consumption data in the US, and in the early 1990s were organized into a relational database format to keep pace with processing advancements for large-scale surveys. That database continues to be used with What We Eat in America/NHANES, the ongoing survey that resulted from the 2002 integration of CSFII with the dietary interview component of NHANES.

The food and nutrient data files, referenced in recent years as either the USDA Survey Nutrient Database or the CSFII Technical Support Files, have been available previously in association with the release of dietary intake data from USDA surveys. For example, with the release of the CSFII 1994–96, 1998 on CD-ROM (US Department of Agriculture, Agricultural Research Service, 2000), a set of such files was included to document how the dietary intake data had been processed. The current objective is to make this database of food information more widely available by providing it on the internet, not only for researchers analyzing national survey data, but also for those conducting other dietary studies.

3. Discussion

3.1. What is the FNDDS?

The FNDDS contains information about foods as they are consumed by the US population. It includes food descriptions, values for food energy and 62 other nutrients, and weights for common food portions. The database does not include dietary supplements. It is maintained by the Food Surveys Research Group (FSRG) in the Beltsville Human Nutrition Research Center of USDA's Agricultural Research Service (ARS), and is based on data files used to process and analyze nationwide food surveys. Versions of the FNDDS are tied to releases of data from What We Eat in America/NHANES, i.e., FNDDS 1.0 was used for survey data collected in 2001–2002, FNDDS 2.0 for 2003–2004, and so on.

The database consists of several separate, but linked, data files. The primary linking field is an 8-digit food code. Together, the files form a normalized, relational database system where data redundancy is minimized. The ten files

Table 1

The components and files of the USDA Food and Nutrient Database for Dietary Studies (FNDDS)

FNDDS components and files	Data contained
<i>Food descriptions</i>	
1. Main food descriptions	The primary description associated with each food code
2. Additional food descriptions	Descriptions for additional foods associated with each main food description, sharing the same nutrient profiles and same food portion weights
<i>Food portions and weights</i>	
3. Food weights	The weights (in grams) for various portions of each food
4. Food portion descriptions	Descriptions for portions of foods and beverages
5. Subcode descriptions	Descriptions for subcodes, which represent foods that are nutritionally similar to a main food, but have different weights for the same portion description
6. Food code–subcode links	Records that show the association between main food descriptions and subcodes
<i>Nutrients</i>	
7. FNDDS nutrient values	A complete nutrient profile (energy and 62 nutrients ^a) for each food code
8. Nutrient descriptions	Descriptions and units of measure associated with the nutrients in the FNDDS
9. Moisture and fat adjustments	Factors used during calculation of the nutrient values for some foods in the database
10. FNDDS–SR links	Information used during calculation of nutrient values in this database; documents the links between the FNDDS and the USDA National Nutrient Database for Standard Reference (SR)

^aNumber of nutrients included in FNDDS 2.0 (2006).

of the FNDDS can be grouped into three components, as described below. Table 1 lists the files in each component and a brief description of each file's contents. Fig. 1 shows a simplified diagram of the FNDDS files and their interrelationships.

3.1.1. Food descriptions component

The food descriptions component includes about 7000 main food descriptions. Each main description in File 1 is linked to a unique 8-digit food code, which is assigned following a structured scheme for grouping foods (Table 2). There are also more than 6500 additional food descriptions in File 2 (about half of which are brand names) linked to the food codes and main descriptions. The additional food descriptions provide information that is useful when coding dietary intake data and trying to assign a reported food the appropriate food code. Table 3 shows an example of the food descriptions linked to a food code.

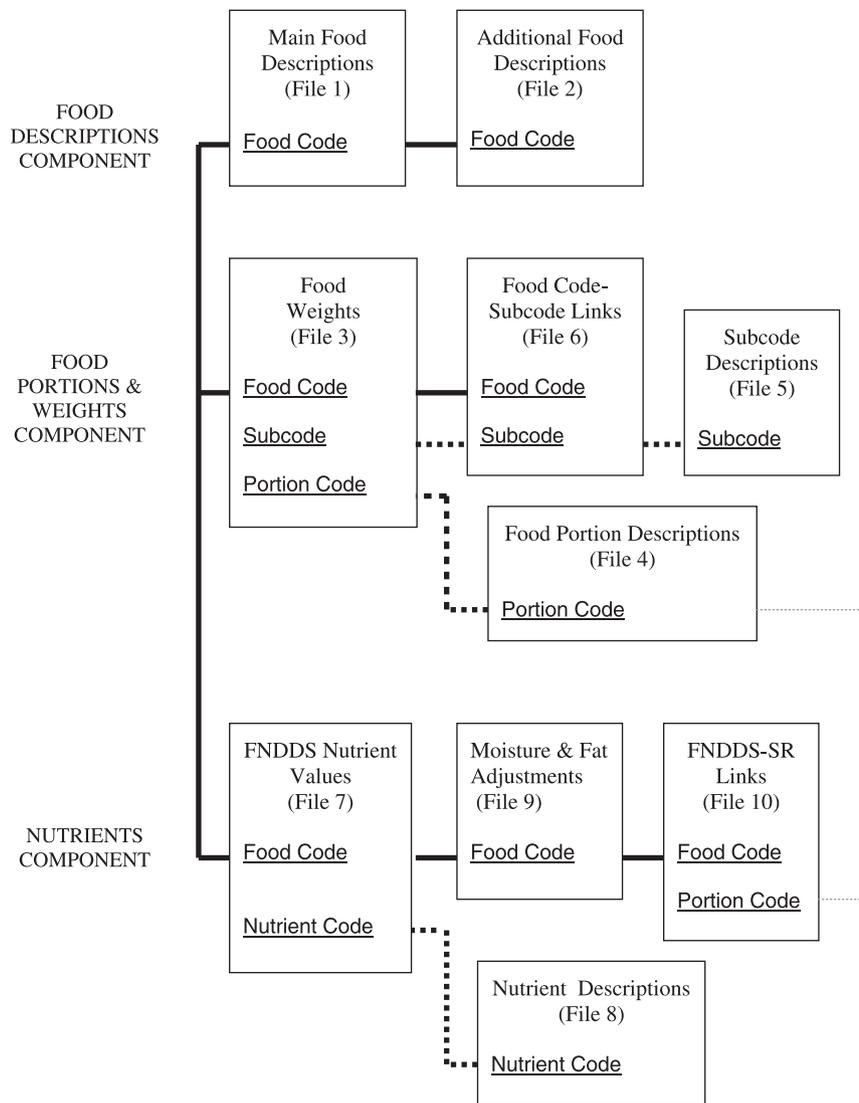


Fig. 1. A simplified diagram of the relationships between the FNDDS components and files. File number in parentheses after file name refers to the order of files as they are listed in Table 1. Food code is the primary link (shown as thick solid lines) between the database components. Secondary links between files (shown as dotted lines) include subcode and portion code in the food portions and weights component, and nutrient code in the nutrients component. Portion code also connects the FNDDS-SR links file to the food portion descriptions file (shown as a faint dashed line).

3.1.2. Food portions and weights component

The food portions and weights component contains approximately 30,000 weights for common portions of foods, including portion weights for many specific brand names. The wide variety of portion weights in the FNDDS makes it easier to code the assortment of food amounts that are reported in dietary studies, particularly for free-living subjects. For each food in the FNDDS, there is a set of portion descriptions appropriate to that food (File 4) and weights for those portions (File 3). Also included in this component are two files (File 5 and File 6) containing data for subcodes, which represent foods that are nutritionally similar to a main food but have different weights for the same portion description. Some examples of food portion descriptions are given in Table 4.

3.1.3. Nutrients component

The nutrients component of the FNDDS includes values for food energy and 62 nutrients/food components for each food code, as listed in Table 5. The source of nutrient values (File 7) and nutrient descriptions (File 8) for the FNDDS is the latest release of the USDA National Nutrient Database for Standard Reference (SR). FNDDS 1.0 is based on SR, Release 16.1; FNDDS 2.0 is based on SR, Release 18 (US Department of Agriculture, Agricultural Research Service, 2005). The SR documentation, available from the Nutrient Data Laboratory's website, includes discussion of the sources of nutrient values which include scientific and technical literature, and unpublished data from food industry, other government agencies, and USDA-contracted research. A source code in the SR nutrient data file indicates if a value was based on

Table 2
FNDDS Food Coding Scheme

A food is assigned an 8-digit number according to a scheme developed by FSRG that outlines the major food groups and subgroups. The first digit in the food code identifies one of the following nine major food groups:

- 1 Milk and milk products
- 2 Meat, poultry, fish and mixtures
- 3 Eggs
- 4 Legumes, nuts and seeds
- 5 Grain products
- 6 Fruits
- 7 Vegetables
- 8 Fats, oils, and salad dressings
- 9 Sugars, sweets, and beverages

The second, third, and sometimes fourth digits of the 8-digit food code identify increasingly specific subgroups, for example:

- 2 Meat, poultry, fish and mixtures
 - 25 Organ meats, sausages and lunchmeats, and meat spreads
 - 252 Frankfurters, sausages, lunchmeats, meat spreads
 - 2521 Frankfurter
 - 2522 Sausages
 - 2523 Luncheon meats

Table 3
Example of the food descriptions linked to a food code

From the main food descriptions file
Food code: 53206000
Food description: Cookie, chocolate chip
Abbreviated description: COOKIE, CHOCOLATE CHIP

From the additional food descriptions file

Food code: 53206000

<i>Seq num</i>	Additional food description
6	Nabisco Chips Ahoy! [®]
8	Grandma's [®]
9	Little Debbie [®]
10	Keebler Rainbow Chips Deluxe [®]

Table 4
Examples of FNDDS food portion descriptions

Types of portion descriptions	Specific examples
Individual portions	Slice, piece
Containers and packages	Can, snack size bar
Brand names (when related to portion size)	1 McDonald's [®] breakfast burrito
Relative size	1 Dannon Sprinkl'ins [®] container
Household measures	Small, medium, large Teaspoon, tablespoon, cup

laboratory analyses or calculated by using appropriate algorithms, factors, or recipes.

The nutrients component of the FNDDS also includes the FNDDS-SR links file (File 10) and the moisture & fat adjustments file (File 9). Those files document how

nutrient values for the FNDDS are calculated from the SR data.

3.2. How can you obtain the FNDDS?

The USDA Food and Nutrient Database for Dietary Studies is available for downloading from the internet (<http://www.ars.usda.gov/ba/bhnrc/fsrg>) in two common formats—Microsoft Access[®] and ASCII. Approximately 60 Mb of disk space are needed to store the uncompressed FNDDS files. MS Access[®] 2000 is needed to use the data imported into an MS Access[®] database. The files may also be imported into other database management programs such as Corel Paradox[®]. Detailed instructions for downloading are provided on the website, as well as extensive documentation that describes the files, their fields and the relationships between files. The website also provides a list of frequently asked questions and answers, links to other sites with applications using the database, and a suggested citation for the FNDDS, as well as a bibliography of research using the survey food intake data and FNDDS data files. An online function to search the data files, called the “What’s in the Foods You Eat Search Tool”, is also available. The website release was reviewed by a group of primary users of the FNDDS data files, and their recommendations for enhancing the website and documentation were incorporated.

The FNDDS is available free and is not copyrighted, but users are asked to cite the database in publications of their research. For example, the suggested citation for FNDDS 2.0 is:

USDA Food and Nutrient Database for Dietary Studies, 2.0 (2006). Beltsville, MD: Agricultural Research Service, Food Surveys Research Group. (<http://www.ars.usda.gov/ba/bhnrc/fsrg>)

Table 5
List of nutrients/food components and units in the FNDDS*

Food energy (kcal)	Vitamin A as retinol activity equivalents (mcg)
Protein (g)	Retinol (mcg)
Carbohydrate (g)	Carotenoids:
Fat, total (g)	Carotene, alpha (mcg)
Alcohol (g)	Carotene, beta (mcg)
	Cryptoxanthin, beta (mcg)
Sugars, total (g)	Lycopene (mcg)
Dietary fiber, total (g)	Lutein + zeaxanthin (mcg)
Water (g)	Vitamin E as alpha-tocopherol (mg)
	Vitamin E, added (mg)
Saturated fatty acids, total (g)	Vitamin K as phyloquinone (mcg)
Monounsaturated fatty acids, total (g)	Vitamin C (mg)
Polyunsaturated fatty acids, total (g)	Thiamin (mg)
Cholesterol (mg)	Riboflavin (mg)
	Niacin (mg)
Individual fatty acids:	Vitamin B-6 (mg)
4:0 (g)	Folate, total (mcg)
6:0 (g)	Folate as dietary folate equivalents (mcg)
	Folic acid (mcg)
8:0 (g)	Food folate (mcg)
10:0 (g)	Vitamin B-12 (mcg)
12:0 (g)	Vitamin B-12, added (mcg)
14:0 (g)	
16:0 (g)	Calcium (mg)
18:0 (g)	Iron (mg)
16:1 (g)	Magnesium (mg)
18:1 (g)	Phosphorus (mg)
20:1 (g)	Potassium (mg)
22:1 (g)	Sodium (mg)
18:2 (g)	Zinc (mg)
18:3 (g)	Copper (mg)
18:4 (g)	Selenium (mcg)
20:4 (g)	
20:5 n-3 (g)	Caffeine (mg)
22:5 n-3 (g)	Theobromine (mg)
22:6 n-3 (g)	

*Nutrients included in FNDDS 2.0 (2006).

3.3. Multi-year database

Each individual FNDDS version is actually a subset of a multi-year (1994-present) database maintained at FSRG. The multi-year version was designed to track changes in foods and facilitate analysis of intake trends in the United States (Anderson et al., 2001). It reflects real changes in foods over time by maintaining data values for different time periods if there were true differences in the food. An example of such differences is the change over time in the values for fortified nutrients in ready-to-eat cereals. Data records in the multi-year database include fields to indicate the valid time period for the data. Other fields categorize changes in values to distinguish between real changes in the food and changes that represent improved analytical data resulting from better procedures for determining the values or more representative samples of foods. Changes to values which are improvements to the data replace previous values in the database.

The multi-year version of the database is not available from the FSRG website, but can be provided to researchers under data sharing agreements. The multi-year database allows a researcher to reanalyze food intake data collected in earlier years, taking advantage of the improved data in a new version of the multi-year database, but maintaining the integrity of food values for the original time period.

3.4. Uses of the FNDDS

The main purpose of the FNDDS is to process the national US dietary survey What We Eat in America/NHANES. This is a continuous survey in which two 24-h dietary recalls are conducted with approximately 5000 individuals each year. Data from the survey are released biennially. Clearly, the FNDDS is useful for analyses of those data. Some examples of how the database files have been used in conjunction with past survey data include: (1) development of a special food grouping scheme to study trends in food consumption (Nielsen et al., 2002); (2) disaggregation of mixed foods to study portions of specialized food groups (Smiciklas-Wright et al., 2002); and (3) addition of food components to the database to expand the nutritional analysis of the survey data (Maras et al., 2004).

The database can also be used in other food intake studies to code foods and amounts and to calculate the energy and nutrient content of those foods, as was done by researchers who compared estimates of food intakes with total energy expenditure (Johnson et al., 1996). The USDA food and nutrient data files have been adapted, or served as models, for national surveys in Egypt (Harrison et al., 2000) and Israel (Shai et al., 2002). Following are a few other dietary assessment applications involving the FNDDS:

- MyPyramidTracker (USDA/CNPP, n.d.),
- Pyramid servings database (USDA/ARS, 2004),
- Food commodity intake database (Bodner and Perloff, 2003; EPA/OPP; USDA/ARS),
- National Cancer Institute Diet History Questionnaire (Dixon et al., 2003).

3.5. How does the FNDDS differ from the CSFII 1994–96, 1998 Technical Support Files?

A number of changes were made to the database files between the CD-ROM release (with the 1994–96, 1998 CSFII intake data) and the FNDDS released over the internet. The types of changes include terminology (names of database, files, and fields), release format, and the structure of the database and files. In addition, many data values were revised and updated. Code numbers, descriptions, and weights were added for new foods to support What We Eat in America/NHANES and other FSRG

dietary research collaborations. Food weights and portions were updated to reflect current fast food and other individually sized products. Many nutrients were added to those previously covered by the database, some nutrients were dropped, units of expression were changed for some nutrients to correspond to the new Dietary Reference Intakes issued by the National Academy of Sciences, and nutrient values were updated based on the latest version of SR. Some specific changes are listed in Table 6.

3.6. Database maintenance and updates

The FNDDS has developed over several decades of USDA Food Surveys (Bodner and Perloff, 2003). The food descriptions and food portions and weights components of the FNDDS are updated regularly to reflect new foods, ethnic foods, nutrient-modified foods, and new package sizes, as required for processing the dietary intakes continuously collected for What We Eat in America/NHANES. Information about new foods and packaging are collected using internet resources, direct contact with manufacturers or from labels in the food market. In addition, a planned program of data review is conducted. Items to be evaluated are selected based on a priority scheme related to frequency of use or contribution to energy intake, for selected age and race-ethnicity groups.

New entries are added to the FNDDS-SR links file as new food codes are added to the food descriptions files. Before each update of the Nutrient Values file, the FNDDS-SR links are revised to reflect updates to SR when appropriate. For example, all links involving ground beef items were revised for the 2001–2002 database to accommodate new entries in the SR for ground beef. Before new nutrients are added, links are reviewed to ensure their appropriateness. For example, food mixtures with vegetables were reviewed in anticipation of adding carotenoids to the database. Links that represent composites for milk, vegetable oil, and some other foods are also reviewed before the nutrient values file is updated. The links are compared with food production and disappearance data from the USDA Economic Research Service and other sources, and the links are revised to reflect the current US marketplace.

The FNDDS nutrient values file is updated every other year, using the latest release of the SR and corresponding with the release of What We Eat in America/NHANES data. Updates include the addition of a complete nutrient profile for each new food, and may also include new nutrients for existing foods.

The FNDDS contains hundreds of thousands of data records and many files interrelated through common fields. This size and complexity necessitate careful quality control practices to ensure accuracy and consistency of the data. A comprehensive quality control plan is in place to ensure that interrelationships are maintained between the various database files and that updates do not introduce errors (Anderson et al., 2004). In addition, historical files are

maintained to provide documentation of changes to database values.

3.7. How does the FNDDS differ from SR?

Although both databases are produced by ARS, they differ because they are designed for different purposes and serve different needs. The SR serves as the standard for food composition information in the US. It is a compilation of data from many sources and provides the foundation for most other databases in the US, including the nutrients component of the FNDDS. Nutrient data for about 2600 SR foods were used to develop nutrient profiles for the approximately 7000 food codes in the FNDDS. One major difference between the FNDDS and SR is that the SR contains data for many foods in their raw or unprepared state, while all the FNDDS values are for foods as consumed. The FNDDS also contains many more food mixtures than SR. The FNDDS-SR links file (formerly known as the recipe ingredients file) and the moisture & fat adjustments file (formerly known as the recipe headers file) document how the FNDDS nutrient values were calculated from the SR for each food code. Nutrient values for food mixtures or “recipes” were calculated according to the retention factor method (Powers and Hoover, 1989). The SR and a retention factors file, used to adjust nutrient values from raw to cooked during recipe calculations, are maintained by the ARS Nutrient Data Laboratory (NDL), and are available on their website at <http://www.ars.usda.gov/ba/bhnrc/ndl> (US Department of Agriculture, Agricultural Research Service, 2003, 2005).

Generally the FNDDS has more portion weights for a food than are usually found in the SR for the same food. The FNDDS includes more options for coding food amounts because it is specifically designed for use with dietary intake studies, where people report intake using a wide variety of terms.

The databases also differ in the nutrient values they contain. The SR includes a larger number of nutrients or food components (up to 136 per food), but may not have values for all components for all foods. The FNDDS has fewer nutrients (63) but no missing values, because nutrients are not added to the FNDDS until values are complete for the SR foods that provide the basis for the FNDDS foods.

Another difference between the databases is the food code structure. SR has 23 different food groups to which foods are assigned, and the group divisions are appropriate for the purposes of collecting and disseminating food composition data. The food group code is a separate field in the SR data records, and the SR code numbers do not always have a specific meaning in terms of food group membership. In the FNDDS, food group identification is incorporated into the 8-digit food code assigned to a food (as shown in Table 2), and the hierarchical grouping is designed for reporting and analyzing food consumption.

Table 6
Changes between the CSFII 1994–96, 1998 Technical Support Files and the FNDDS

Changed item	Previous	New
Database name	CSFII Technical Support Files, 1994–96, 1998	USDA Food and Nutrient Database for Dietary Studies (FNDDS)
File names	Recipe headers file	Moisture & fat adjustments file
	Recipe ingredients file	FNDDS–SR links file
	Food includes file	Additional food descriptions file
	Subcodes file	Food code–subcode links file
Release format/medium	CD-ROM, available for sale from National Technical Information Service	Free download from FSRG website
Format of data files/records	ASCII only	Microsoft Access [®] and ASCII
Data—food descriptions	—	Added code numbers and descriptions for new foods reported in What We Eat in America/ NHANES
Data—food portions and weights	—	Updated food weights and portions to reflect fast food and other individually sized products
Data—nutrients	—	Dropped: vitamin A (IU), vitamin A (RE), carotene, vitamin E (ATE)
	—	Added with Version 1.0: total sugars, retinol, vitamin A in retinol activity equivalents (RAE), alpha carotene, beta carotene, beta cryptoxanthin, lycopene, lutein & zeaxanthin (a single value for the sum), vitamin E as alpha-tocopherol, vitamin K, folic acid, food folate, and folate in dietary folate equivalents (DFE)
	—	Added with Version 2.0: vitamin E, added and vitamin B-12, added
—	—	Updated nutrient values and units of expression based on latest version of SR (SR 16-1 used for FNDDS 1.0, SR 18 used for FNDDS 2.0)
Number of decimal places to which nutrient values are rounded	All nutrient values expressed to three decimal places	Number of decimal places varies with nutrient; rounding is consistent with SR
Term used to describe food amounts	Measure descriptions	Portion descriptions
Location of food descriptions and portion weight information	Files were part of the “food coding database” (or “the codebook”)	Separated into 2 components of the FNDDS – “food descriptions” and “food portions and weights”
Location of food code-subcode links and subcode descriptions files	Part of the food coding database	Part of the Food Portions and Weights component of the FNDDS
Name and location of files that store the information used to calculate nutrient values for foods	Released as a separate ‘recipe database’	FNDDS–SR links file and moisture & fat adjustments file, included with the Nutrients component of the FNDDS
Location of files with descriptions and nutrient values for SR foods used in the FNDDS–SR links file	Descriptions and nutrients were contained in the “Primary Data Set (PDS)” files, that were part of the “nutrient database and related files”	Nutrient values for basic components drawn directly from the SR; users directed to NDL website for more information
Location of factors to adjust for nutrient changes from cooking	Retention Factors file released as part of nutrient database	Not released with FNDDS; file available on NDL website

4. Conclusion

The FNDDS, which is used to process and analyze national food surveys, is now readily accessible on the internet. The database may be used in conjunction with research utilizing dietary data from What We Eat in America/NHANES, or it may be used for other dietary studies, to provide comparability with national data. The FNDDS provides information to use for coding dietary intakes and analyzing those intakes for nutrient content. To learn more, researchers are encouraged to explore the FSRG website and try out the FNDDS data files (<http://www.ars.usda.gov/ba/bhnrc/fsrg>). Other learning opportunities provided by FSRG and described on the website include workshops and a listserv for email announcements about the FNDDS, What We Eat in America, and other FSRG products and activities.

Disclaimer

Mention of commercial products in this article is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the US Department of Agriculture over others not mentioned.

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