

## **Flavonoid Values for USDA Survey Foods and Beverages 2007-2008:**

Provisional Flavonoid Addendum to the  
USDA Food and Nutrient Database for Dietary Studies, 4.1,  
and  
Flavonoid Intake Data Files from What We Eat in America (WWEIA),  
National Health and Nutrition Examination Survey (NHANES) 2007-2008

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***Please note: In this December 2015 revision, values for 54 USDA survey food codes have been updated to reflect the revised delphinidin value for raw bananas (NDB number 09040) in the USDA Database for the Flavonoid Content of Selected Foods, Release 3.2 (September 2015; [www.ars.usda.gov/nea/bhnrc/ndl](http://www.ars.usda.gov/nea/bhnrc/ndl)).***

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# CONTENTS

<b>LIST OF ACRONYMS .....</b>	<b>4</b>
<b>WHAT PRODUCTS ARE INCLUDED IN THE FLAVONOID VALUES FOR USDA SURVEY FOODS AND BEVERAGES 2007-2008? .....</b>	<b>5</b>
Who developed the Flavonoid Values for USDA Survey Foods and Beverages? .....	5
<b>THE PROVISIONAL FLAVONOID ADDENDUM.....</b>	<b>6</b>
What is the Provisional Flavonoid Addendum? .....	6
Context for understanding the Provisional Flavonoid Addendum .....	7
How is the Provisional Flavonoid Addendum related to the FNDDS? .....	9
How can I obtain the Provisional Flavonoid Addendum? .....	9
How were flavonoid values in the Provisional Flavonoid Addendum calculated? .....	10
<i>Tea codes: Nutrient profile based on composite .....</i>	<i>10</i>
<i>Minor ingredients: “5-percent rule” and exceptions .....</i>	<i>11</i>
<i>Isoflavone considerations .....</i>	<i>12</i>
<i>Retention factors for cooked foods.....</i>	<i>13</i>
What is the structure of the Provisional Flavonoid Addendum? .....	14
Provisional Flavonoid Addendum file formats .....	15
<i>Main food descriptions (MainFoodDesc).....</i>	<i>15</i>
<i>Flavonoid values (FlavVal).....</i>	<i>16</i>
<i>Flavonoid descriptions (FlavDesc).....</i>	<i>17</i>
Limitations of the Provisional Flavonoid Addendum.....	18
<b>THE FLAVONOID INTAKE DATA FILES.....</b>	<b>19</b>
What are the Flavonoid Intake Data Files? .....	19
Flavonoid Intake Data Files description and format .....	19
<b>LITERATURE CITED.....</b>	<b>25</b>

## **LIST OF ACRONYMS**

FDB-EXP = USDA's Expanded Flavonoid Database for the Assessment of Dietary Intakes

FNDDS = USDA Food and Nutrient Database for Dietary Studies

NCHS = National Center for Health Statistics

NHANES = National Health and Nutrition Examination Survey

SNS = Supplemental Nutrition Survey of Older Americans

SR = USDA National Nutrient Database for Standard Reference

USDA = U.S. Department of Agriculture

WWEIA = What We Eat in America

## WHAT PRODUCTS ARE INCLUDED IN THE FLAVONOID VALUES FOR USDA SURVEY FOODS AND BEVERAGES 2007-2008?

Three products are included in this release:

- The *Provisional Flavonoid Addendum to the USDA Food and Nutrient Database for Dietary Studies, 4.1* (called the “Provisional Flavonoid Addendum” for short; filename = Provisional\_Flavonoid\_Addendum). This database addendum provides flavonoid values for all foods/beverages in the USDA Food and Nutrient Database for Dietary Studies (FNDDS) version 4.1 (1), which corresponds to dietary data from What We Eat in America (WWEIA), National Health and Nutrition Examination Survey (NHANES) 2007-2008.
- The *Flavonoid Intake Data Files* from What We Eat in America (WWEIA), National Health and Nutrition Examination Survey (NHANES) 2007-2008. These four SAS<sup>®</sup> data files (called the “Flavonoid Intake Data Files” for short) include:
  - For each food/beverage report, the amounts of 29 individual flavonoids, 6 flavonoid classes, and total flavonoids consumed on day 1 (flav\_dr1iff\_0708.sas7bdat) and day 2 (flav\_dr2iff\_0708.sas7bdat).
  - For each respondent, the total amounts of 29 individual flavonoids, 6 flavonoid classes, and total flavonoids consumed on day 1 (flav\_dr1tot\_0708.sas7bdat) and day 2 (flav\_dr2tot\_0708.sas7bdat).
- This *documentation file* (FlavonoidDB\_documentation.docx), which explains the development of the database and SAS<sup>®</sup> datasets listed above.

## Who developed the Flavonoid Values for USDA Survey Foods and Beverages?

The USDA Food Surveys Research Group (FSRG) developed the Flavonoid Values for USDA Survey Foods and Beverages using data provided by the USDA Nutrient Data Laboratory and supported by partial funding from the Office of Dietary Supplements, National Institutes of Health.

# THE PROVISIONAL FLAVONOID ADDENDUM

## What is the Provisional Flavonoid Addendum?

- A special, provisional database of flavonoid values for all foods/beverages in the FNDDS 4.1, which corresponds to dietary intake data from WWEIA, NHANES 2007-2008 (2).
- Provides the amounts of 29 flavonoids in 6 flavonoid classes (table 1) present in 100 grams of each food/beverage. Most (24) of the individual flavonoids included in the database are monomers, the 4 theaflavins are dimers, and the thearubigins are polymers.

**Table 1 - Flavonoids in the Provisional Flavonoid Addendum**

<i>Class</i>	<i>Name</i>
<b><i>Anthocyanidins</i></b>	Cyanidin
	Delphinidin
	Malvidin
	Pelargonidin
	Peonidin
	Petunidin
<b><i>Flavan-3-ols</i></b>	(-)-Epicatechin
	(-)-Epicatechin 3-gallate
	(-)-Epigallocatechin
	(-)-Epigallocatechin 3-gallate
	(+)-Catechin
	(+)-Gallocatechin
	Theaflavin
	Theaflavin-3,3'-digallate
	Theaflavin-3'-gallate
	Theaflavin-3-gallate
	Thearubigins
<b><i>Flavanones</i></b>	Eriodictyol
	Hesperetin
	Naringenin
<b><i>Flavones</i></b>	Apigenin
	Luteolin
<b><i>Flavonols</i></b>	Isorhamnetin
	Kaempferol
	Myricetin
	Quercetin
<b><i>Isoflavones</i></b>	Daidzein
	Genistein
	Glycitein

- Based on the USDA's Expanded Flavonoid Database for the Assessment of Dietary Intakes (3), also known as FDB-EXP.

- As explained in the FDB-EXP documentation, flavonoid values are reported as aglycones (*reference 4, pages 2 and 5*).
- Neither FDB-EXP nor the Provisional Flavonoid Addendum includes estimates of the proanthocyanidin content of foods, which can be substantial (*5-7*).

## Context for understanding the Provisional Flavonoid Addendum

Many chemical compounds in foods and beverages are called “bioactive components,” and some may play important roles in promoting health and preventing disease (*8-10*). Flavonoids are a large class of bioactive polyphenolic compounds that occur naturally in plants (*11-12*). Levels of specific flavonoids vary from plant to plant and from food to food. Many people are interested in knowing how flavonoids are related to human health, and much research is being done on this topic (*8, 12*).

The intake of flavonoids is difficult to assess for many reasons. One factor that has made it difficult for researchers to study relationships between flavonoids and health is the need for more comprehensive databases of flavonoid values in foods and beverages (*12-14*). An additional challenge is the fact that analytic data on the flavonoid content of foods show large variation due to the numerous factors that affect their content, including environmental stresses, cultivar, processing and storage conditions, and preparation methods (*15-17*).

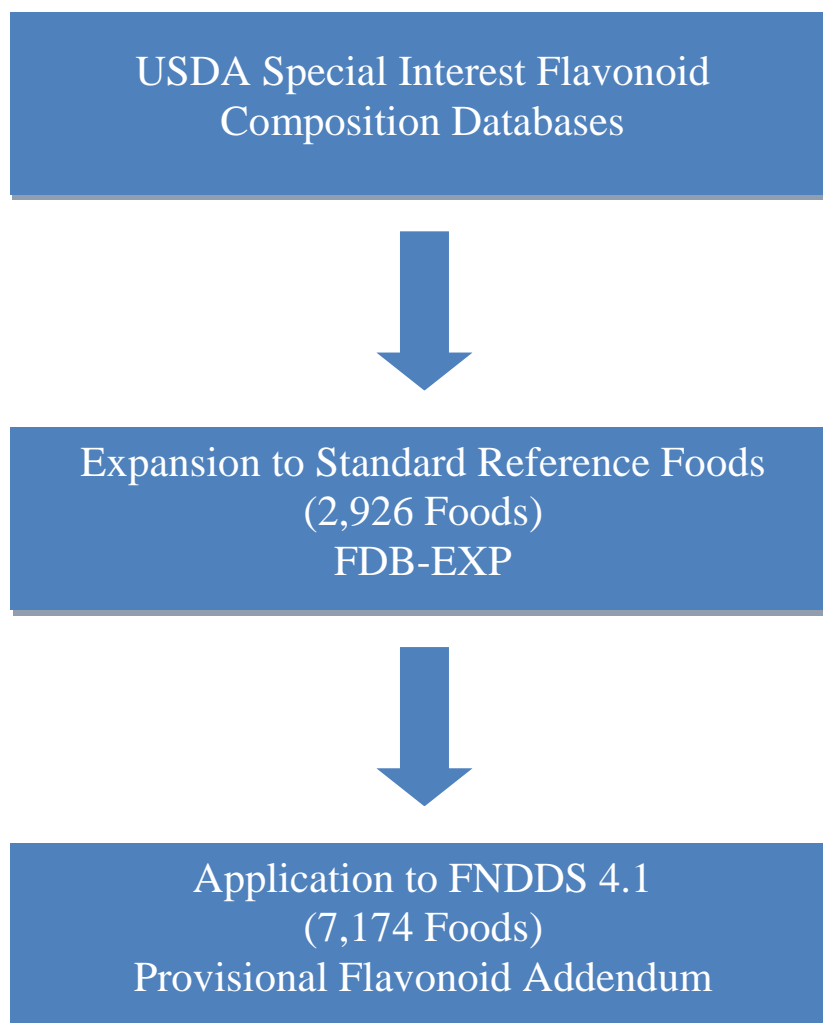
Taking into account these limitations, the Food Surveys Research Group (FSRG) has created a provisional database that can be used to estimate flavonoid intakes in the United States. The Provisional Flavonoid Addendum is a step toward closing a gap in the knowledge base about intake of flavonoids. It provides flavonoid values for all foods/beverages in the FNDDS 4.1, which was the version of the database used in coding dietary intake data and calculating nutrient intakes from WWEIA, NHANES 2007-2008. By doing that, the Provisional Flavonoid Addendum makes it possible to generate the nationally representative estimates of flavonoid intakes by people of all ages in the United States that are included in this release. The ability to link flavonoid intakes from WWEIA with other health-related data that are included in NHANES opens up new possibilities for research on relationships between flavonoid intakes and health.

The [FNDDS 4.1](#) contains descriptions of 7,174 food/beverage items, each with its own 8-digit food code and associated nutrient profile (*1*). FNDDS 4.1 nutrient profiles are based on information from the USDA National Nutrient Database for Standard Reference (SR), release 22, which was developed by the USDA Nutrient Data Laboratory (*18*).

SR does not yet include flavonoid values. However, the Nutrient Data Laboratory updated and expanded two of their special interest databases (*4, 19*) to create the FDB-EXP (*3*). (*For more detail about how FDB-EXP was created, read its documentation file; 3.*) FDB-EXP provides 29 flavonoid values for about 2,900 SR items (approximately half of which had at least one nonzero flavonoid value) that were used as the basis for determining the flavonoid values in the Provisional Flavonoid Addendum to the FNDDS 4.1.

The different flavonoid databases produced by USDA and the relationships among them are illustrated in Figure 1.

Figure 1. Relationships among USDA's flavonoid databases



The Provisional Flavonoid Addendum was applied to WWEIA, NHANES 2007-2008 dietary data, to produce the four Flavonoid Intake Data Files, which are described in more detail beginning on page 19.



## How is the Provisional Flavonoid Addendum related to the FNDDS?

Table 2 - Similarities and differences between FNDDS 4.1 and the Provisional Flavonoid Addendum

	<i>FNDDS 4.1</i>	<i>Provisional Flavonoid Addendum</i>
<b><i>Time period it represents</i></b>	2007-2008	2007-2008
<b><i>Dietary intake data it corresponds to</i></b>	WWEIA, NHANES 2007-2008	WWEIA, NHANES 2007-2008
<b><i>Basis for nutrient/ flavonoid data</i></b>	USDA National Nutrient Database for Standard Reference, Release 22 (18)	USDA's Expanded Flavonoid Database for the Assessment of Dietary Intakes (3)
<b><i>Data files included:</i></b>		
<i>Main food descriptions</i>	7,174	7,174
<i>Total number of FNDDS nutrient values/ flavonoid values</i>	466,310	208,046
<i>Nutrient descriptions/ flavonoid descriptions</i>	65 nutrients/food components	29 flavonoids

## How can I obtain the Provisional Flavonoid Addendum?

You can download this database from the FSRG website (20). It is available in 3 formats – ASCII, Microsoft Access®, and SAS®. It includes 3 tables or data files – Main Food Descriptions, Flavonoid Values, and Flavonoid Descriptions. Each version of the database is downloadable as a single self-extracting executable PKZip® data file that contains all three tables or data files and the documentation.

## How were flavonoid values in the Provisional Flavonoid Addendum calculated?

For the most part, flavonoid values in the Provisional Flavonoid Addendum were calculated in the same way as the nutrient values in the FNDDS were calculated. As described in the FNDDS 4.1 documentation (1; see “Nutrients Component” section), data for about 2,900 of the items in SR22 were used to determine the nutrient values for the 7,174 foods in the FNDDS 4.1. For many items in FNDDS 4.1, nutrient profiles were calculated using more than one of those 2,900 SR22 items. The specific SR items that were used to generate values for each survey food code in FNDDS 4.1, and their proportions, are identified in the FNDDS-SR Links file of FNDDS 4.1.

Sometimes the set of FNDDS-SR Links providing the documentation for the 65 nutrients/components for an item in FNDDS 4.1 was not the best match for calculating flavonoid values for that item. To assure more representative flavonoid values, it was necessary to modify existing FNDDS-SR links for selected items. In some cases, such as for tea, a somewhat different set of SR items was used to calculate the flavonoid values for the Provisional Flavonoid Addendum than had been used to calculate nutrient values for the FNDDS 4.1. In other cases, FNDDS-SR Links were changed somewhat in order to ensure the consistency of flavonoid values across related foods. These changes and other considerations are described below.

### **Tea codes: Nutrient profile based on composite**

Black tea and green tea differ considerably in their flavonoid profiles (4). For example, black tea is higher in theaflavins and thearubigins, and green tea is higher in catechins, epicatechins, and epigallocatechins. However, when the WWEIA, NHANES 2007-2008 data were collected and coded, no SR code for green tea was available, and, consequently, black and green tea reports were both assigned FNDDS codes with nutrient values based on SR information for black tea alone. The differing flavonoid contents of green and black tea necessitated the addition of a new SR code for green tea. In the addendum, FNDDS codes for tea have flavonoid values derived from a composite consisting of 84% black tea and 16% green tea that is based on published market share data (21).

*Note for researchers collecting their own dietary intakes with the intention of measuring flavonoid intakes:* It is strongly encouraged that you query respondents who report tea as to the type of tea consumed. If you do so, then for tea reports only, we suggest that you apply the flavonoid profiles for green tea and black tea that are available in FDB-EXP (3) at this writing, rather than those in the Provisional Flavonoid Addendum, in order to obtain more accurate individual flavonoid intakes specific to the type of tea consumed. Beginning in 2013, if a participant in WWEIA, NHANES reports drinking brewed tea, a follow-up question about the type of tea is asked (“Was it made from black tea, green, herbal, ... or something else.?”)

### **Minor ingredients: “5-percent rule” and exceptions**

For many foods in the Provisional Flavonoid Addendum, flavonoid values were based on a combination of multiple items (“ingredients”) from the FDB-EXP. When the USDA Nutrient Data Laboratory calculated flavonoid values for the FDB-EXP, they omitted any ingredient that accounted for less than five percent of the weight of the food (3), except when the ingredient was high in flavonoids and likely to be a major contributor of flavonoids, such as cocoa powder (alkalinized or regular), soy protein isolate, or soy flour. The same “5-percent rule” and the same exceptions (with some additions, as outlined in the next paragraph) were applied in the development of the Provisional Flavonoid Addendum, for the following reasons:

- In WWEIA, NHANES, the protocols for interviewing and subsequent coding are designed to capture complete information on intake of macronutrients, vitamins, and minerals. The protocols are not designed to maximize information about every specific ingredient, especially not ingredients that do not provide a significant amount of any of those components.
- Respondents often do not know details about minor ingredients in the foods and beverages they consume. This is especially relevant to commercially prepared foods, which account for a growing percentage of all food reports.
- Often a single food code in the Provisional Flavonoid Addendum may represent a variety of foods that differ in the presence/absence of high-flavonoid ingredients such as seasonings and flavorings. Those ingredients may or may not be included in the “recipes” for these food codes.

In addition to the exceptions to the 5-percent rule that were made in the creation of the FDB-EXP, a number of other exceptions were made when assigning flavonoid values to foods in the Provisional Flavonoid Addendum. Minor ingredients were NOT omitted that (a) are concentrated sources of at least one of the flavonoids of interest and (b) were asked about in the WWEIA, NHANES 2007-2008 dietary interview and/or are common recipe ingredients used consistently in many foods in the FNDDS/Provisional Flavonoid Addendum. Ingredients in FNDDS foods that met at least one of these criteria were always included in calculating flavonoid values even when they accounted for less than five percent of an item’s total weight. These ingredients are shown in table 3, along with the flavonoids that are affected.

**Table 3 - Ingredients included in calculating flavonoid values even when present in small amounts**

<i>Ingredient</i>	<i>Relevant flavonoid(s)</i>	
	<i>Class</i>	<i>Name</i>
<b><i>Cocoa/chocolate</i></b>	Flavan-3-ols	(-)-Epicatechin (+)-Catechin
<b><i>Tea</i></b>	Flavan-3-ols	All
	Flavonols	Kaempferol Myricetin Quercetin
<b><i>Soy-based products</i></b>	Isoflavones	Daidzein Genistein Glycitein
<b><i>Onions</i></b>	Flavonols	Isorhamnetin Quercetin
<b><i>Chili peppers</i></b>	Flavones	Luteolin
	Flavonols	Quercetin
<b><i>Sweet peppers</i></b>	Flavones	Luteolin
<b><i>Berries</i></b>	Anthocyanidins	Cyanidin Delphinidin Malvidin Pelargonidin Peonidin Petunidin
<b><i>Lemon (juice, peel)</i></b>	Flavanones	Eriodictyol Hesperetin
<b><i>Dark-green leafy vegetables</i></b>	Flavonols	Kaempferol
<b><i>Celery</i></b>	Flavones	Apigenin Luteolin

### **Isoflavone considerations**

A preliminary review of the data indicated that in 2007-2008 the predominant source of isoflavones by far was soy-based foods/beverages. Top contributors of isoflavones were items that were composed predominantly of soy ingredients, for example, soy-based infant formula, soy milk, and tofu. For items with isoflavones provided primarily by major ingredients, the isoflavone values that were present in the FDB-EXP were retained.

Most of the remainder of isoflavone intake came from functional ingredients, meaning ingredients that are added to a food/beverage to serve a particular purpose. Many items contain soy additives that serve as stabilizers or emulsifiers. However, some items that are alike in most

ways but differ in the presence/absence of soy-based functional ingredients are coded using the same FNDDS code and thus are given the same flavonoid profile. For example, two different brands of beef frankfurter would be coded with the same FNDDS code, even if one brand has soy ingredients and the other does not.

For those reasons, isoflavone values were set to zero when (a) the FDB-EXP contained non-zero isoflavone values for a given SR code, but (b) isoflavones in such a food would be provided by a functional ingredient that may or may not be present in all foods of that type. Foods for which isoflavone values were retained due to the near-universal presence of soy-based functional ingredients were doughnuts and meal replacement bars (22,23).

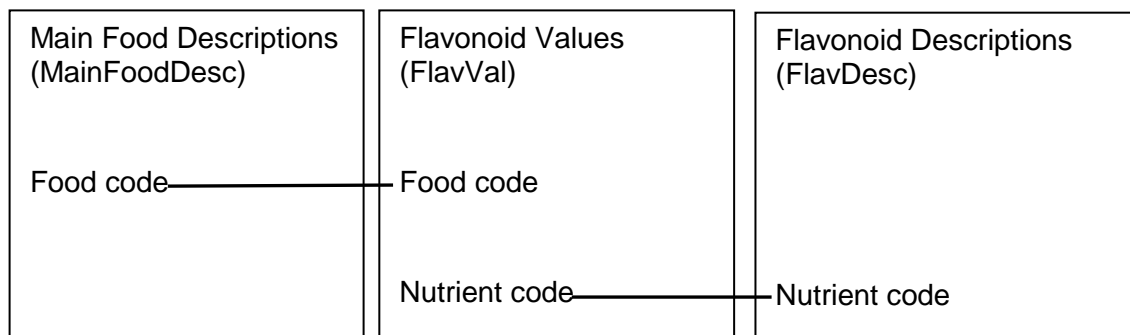
Isoflavone values for eggs were set to zero because they were based on one small study of eggs obtained in a specific geographical region. The Data Quality Evaluation System used by the USDA Nutrient Data Laboratory assigned the isoflavone values for eggs a quality rating that fell into their lowest category (a confidence code of "D") due to limitations of the data (19). The effect of omitting eggs from calculation of isoflavone intakes per se is likely to be negligible, though it does affect estimates of the percentage of individuals with zero intake of isoflavones.

### **Retention factors for cooked foods**

Retention factors to account for cooking method were applied to the flavonoid values in a manner consistent with the method described in the FDB-EXP documentation (3). Briefly, for moist-heat cooking methods, a loss of 15% was applied to flavonols, flavanols, flavanones, and flavones and 50% to anthocyanidins. No loss was assumed for dry-heat cooking methods such as baking. No retention factors were applied to isoflavones, because analytical values were available for both raw and cooked/processed versions of most foods that contain isoflavones.

## What is the structure of the Provisional Flavonoid Addendum?

The Provisional Flavonoid Addendum contains 3 data files or tables. The diagram below illustrates the interrelationships among them.



The food code field and the nutrient code field serve as linking fields between different tables in the database.

The Main Food Descriptions file has one record for each food code. There are 7,174 food codes in all. The format of the Main Descriptions file is provided on page 15.

The Flavonoid Values file contains 29 records for each food code (1 record for each of the 29 flavonoids that are included; 208,046 records in all). Each record is linked to the Main Food Descriptions through the 8-digit food code and to the Flavonoid Descriptions through the 3-digit nutrient code. The format of the Flavonoid Values file is provided on page 16.

The Flavonoid Descriptions file contains 29 records, 1 for each of the 29 flavonoids included in the database. The format of the Flavonoid Descriptions file is provided on page 17.

## Provisional Flavonoid Addendum file formats

### Main food descriptions (MainFoodDesc)

The main food description is the primary (usually generic) complete description identified by a unique 8-digit food code. The food code links the main food description to other database files. The file has one record for each food code (7,174 records in all).

**Table 4 - Format of Main Food Descriptions file<sup>1</sup>**

<i>Field Name</i>	<i>Field Type</i>	<i>Description</i>
<b><i>Food code</i></b> ‡	N 8*	A unique 8-digit number assigned to a particular main food description.
<b><i>Start date</i></b>	D (MM/DD/YYYY)	For the Provisional Flavonoid Addendum, all start and end dates are the same (1/1/2007 and 12/31/2008, respectively). They correspond to the time period for WWEIA, NHANES 2007-2008.
<b><i>End date</i></b>	D (MM/DD/YYYY)	
<b><i>Main food description</i></b>	A 200	A complete description for a food, often including preparation method (e.g., boiled) and original form of the food (e.g., from frozen); usually generic in nature.

<sup>1</sup>The Main Food Descriptions File in the Provisional Flavonoid Addendum is identical to that in the FNDDS 4.1.

‡Linking field; used to link different files within the database.

N = numeric field. Number following field type indicates field length.

\*Indexed field (holds values by which the file is ordered). Although ASCII delimited files do not have indexes, they are identified in this document to show the order of records.

A = alphanumeric field. Number following field type indicates field length.

### **Flavonoid values (FlavVal)**

For each food code in the Main Food Descriptions file, the Flavonoid Values file contains one record for each of the 29 flavonoids that are included (208,046 records in all). Flavonoids are identified by the nutrient code, which links to the Flavonoid Descriptions file.

**Table 5 - Format of Flavonoid Values file**

<b>Field Name</b>	<b>Field Type</b>	<b>Description</b>
<b>Food code‡</b>	N 8*	A unique 8-digit number assigned to a particular main food description.
<b>Nutrient code‡</b>	N 3*	Identifies a flavonoid; corresponds to Nutr_No in FDB-EXP (3).
<b>Start date</b>	D (MM/DD/YYYY)*	For the Provisional Flavonoid Addendum, all start and end dates are the same (1/1/2007 and 12/31/2008, respectively). They correspond to the time period for WWEIA, NHANES 2007-2008.
<b>End date</b>	D (MM/DD/YYYY)	
<b>Nutrient value</b>	N 10.2	Amount of nutrient (flavonoid) in 100 grams edible portion of the food; follows conventions in FDB-EXP (3).

‡Linking field; used to link different files within the database.

N = numeric field. Number following field type indicates field length; number after decimal point indicates number of decimal places.

\*Indexed field (holds values by which the file is ordered). Although ASCII delimited files do not have indexes, they are identified in this document to show the order of records.



### **Flavonoid descriptions (FlavDesc)**

This file contains the name (flavonoid description) for each flavonoid (nutrient code) included in the Flavonoid Values file (29 records in all). The nutrient codes, flavonoid descriptions, units of expression, and number of decimal places to which values are expressed are consistent with similar fields in the FDB-EXP.

**Table 6 - Format of Flavonoid Descriptions file**

<i>Field Name</i>	<i>Field Type</i>	<i>Description</i>
<b><i>Nutrient code‡</i></b>	N 3*	Identifies a flavonoid.
<b><i>Flavonoid description</i></b>	A 45	Name of the flavonoid.
<b><i>Flavonoid class</i></b>	A 45	The class of flavonoids to which the individual flavonoid belongs.
<b><i>Tagname</i></b>	A 15	The nutrient or food component name or “tag” assigned by INFOODS, the International Network of Food Data Systems, for international interchange of nutrient data (24). For 10 of the 29 flavonoids included in the Provisional Flavonoids Addendum, this is a missing value.
<b><i>Unit</i></b>	A 10	The measurement unit in which values for the nutrient are expressed.
<b><i>Decimals</i></b>	N 2	The number of decimal places to which the nutrient (flavonoid) value is expressed, following conventions in FDB-EXP (3).

‡Linking field; used to link different files within the database.

N = numeric field. Number following field type indicates field length.

\*Indexed field (holds values by which the file is ordered). Although ASCII delimited files do not have indexes, they are identified in this document to show the order of records.

A = alphanumeric field. Number following field type indicates field length.

## Limitations of the Provisional Flavonoid Addendum

- Papers that include estimates of flavonoid intake based upon values in the Addendum should contain a statement about the provisional nature of the database as one of the limitations of the research. The Provisional Flavonoid Addendum is called “provisional” because the flavonoid data do not meet the same standard of quality as the nutrient data in the database that is updated every two years (the FNDDS). For example, only a small percentage of the flavonoid values in the FDB-EXP are analytical ( $\approx 3\%$ ). About 24% of values were imputed based on data for similar foods. The majority ( $\approx 73\%$ ) of values were assigned logical zeroes, that is, a value was assumed to be zero when the flavonoid in question was not expected to be present in a particular food item. Assignment of flavonoid values to foods is explained in detail in the FDB-EXP documentation (3).
- The foods and beverages and their flavonoid profiles that are contained in the Provisional Flavonoid Addendum represent items as available in the marketplace and consumed in 2007-2008. Some underlying assumptions that are correct for 2007-2008 may not be correct for other time periods. For that reason, we do not recommend applying values from the Addendum to dietary intake data collected in other time periods. If researchers choose to do so, caution should be used in interpreting results, and this issue should be included as a limitation of the analysis.
- As described in the section "Isoflavone considerations," isoflavone values were set to zero when (a) the FDB-EXP contained non-zero isoflavone values for a given SR code, but (b) isoflavones in such an item would be provided by a functional ingredient that may or may not be present in all items of that type. Overall, this conservative approach of setting to zero the isoflavone contributions of the items in question will yield lower estimates of isoflavone intake.

# THE FLAVONOID INTAKE DATA FILES

## What are the Flavonoid Intake Data Files?

- The result of applying flavonoid values from the Provisional Flavonoid Addendum to dietary intake data from WWEIA, NHANES 2007-2008 (2).
- Provide data used in estimating nationally representative estimates of flavonoid intakes by people of all ages in the United States in 2007-2008.
- Correspond in format and naming convention to the Individual Foods and Total Nutrients files from WWEIA, NHANES.

## Flavonoid Intake Data Files description and format

The USDA Food Surveys Research Group used the Provisional Flavonoid Addendum and dietary intake data from WWEIA, NHANES 2007-2008 to create four SAS® format files containing flavonoid intakes per food/beverage report and per day. The resulting files allow researchers to analyze flavonoid intake separately or, through the key identifiers, together with the nutrients and dietary components already available from WWEIA and/or other NHANES data.

Table 7 lists the four Flavonoid Intake Data Files. Flavonoid values for each food/beverage report in the WWEIA, NHANES individual foods files were calculated as the amount of the food in the original file times the flavonoid values per 100 g for the specific food code. The total nutrients files contain daily totals for each of 29 flavonoids and 6 flavonoid classes, as well as the sum total of all flavonoids.

**Table 7 - Flavonoid Intake Data Files created using the Provisional Flavonoid Addendum and the dietary intake files of What We Eat in America, National Health and Nutrition Examination Survey (WWEIA, NHANES) 2007-2008**

<i>Type of data</i>	<i>Name of Flavonoid intake Data File</i>	<i>Key identifier(s)</i>	<i>Number of records</i>	<i>Name (description) of corresponding WWEIA, NHANES file</i>
<b>Individual foods</b>	<i>flav_dr1iff_0708.sas7bdat</i> (Day 1 Individual Foods Flavonoid File)	SEQN, DR1ILINE	145,703	DR1IFF_E.xpt (Day 1 Individual Foods File)
	<i>flav_dr2iff_0708.sas7bdat</i> (Day 2 Individual Foods Flavonoid File)	SEQN, DR2ILINE	121,341	DR2IFF_E.xpt (Day 2 Individual Foods File)
<b>Total nutrients</b>	<i>flav_dr1tot_0708.sas7bdat</i> (Day 1 Total Flavonoid File)	SEQN	9,762	DR1TOT_E.xpt (Day 1 Total Nutrient File)
	<i>flav_dr2tot_0708.sas7bdat</i> (Day 2 Total Flavonoid File)	SEQN	9,762	DR2TOT_E.xpt (Day 2 Total Nutrient File)

Lists of variables in the Flavonoid Intake Data Files are shown in tables 8 and 9. Each of the four files is an extension of the corresponding WWEIA, NHANES 2007-2008 dietary intake file and contains records for the same individuals and food reports. Documentation for the WWEIA, NHANES 2007-2008 survey data files is found at <http://wwwn.cdc.gov/nchs/nhanes/search/datapage.aspx?Component=Dietary&CycleBeginYear=2007>.

**Table 8. Variables in the Flavonoid Intake Individual Food Files (“per food report” files)**

<i>Day 1 variable name</i>	<i>Day 2 variable name</i>	<i>Description<sup>1</sup></i>
<b>seqn</b>	<b>seqn</b>	Respondent sequence number
<b>dr1iline</b>	<b>dr2iline</b>	Food/Individual component number
<b>dr1i_fl710</b>	<b>dr2i_fl710</b>	710 Daidzein (mg) [Isoflavones]
<b>dr1i_fl711</b>	<b>dr2i_fl711</b>	711 Genistein (mg) [Isoflavones]
<b>dr1i_fl712</b>	<b>dr2i_fl712</b>	712 Glycitein (mg) [Isoflavones]
<b>dr1i_fl731</b>	<b>dr2i_fl731</b>	731 Cyanidin (mg) [Anthocyanidins]
<b>dr1i_fl740</b>	<b>dr2i_fl740</b>	740 Petunidin (mg) [Anthocyanidins]
<b>dr1i_fl741</b>	<b>dr2i_fl741</b>	741 Delphinidin (mg) [Anthocyanidins]
<b>dr1i_fl742</b>	<b>dr2i_fl742</b>	742 Malvidin (mg) [Anthocyanidins]
<b>dr1i_fl743</b>	<b>dr2i_fl743</b>	743 Pelargonidin (mg) [Anthocyanidins]
<b>dr1i_fl745</b>	<b>dr2i_fl745</b>	745 Peonidin (mg) [Anthocyanidins]
<b>dr1i_fl749</b>	<b>dr2i_fl749</b>	749 (+)-Catechin (mg) [Flavan-3-ols]
<b>dr1i_fl750</b>	<b>dr2i_fl750</b>	750 (-)-Epigallocatechin (mg) [Flavan-3-ols]
<b>dr1i_fl751</b>	<b>dr2i_fl751</b>	751 (-)-Epicatechin (mg) [Flavan-3-ols]
<b>dr1i_fl752</b>	<b>dr2i_fl752</b>	752 (-)-Epicatechin 3-gallate (mg) [Flavan-3-ols]
<b>dr1i_fl753</b>	<b>dr2i_fl753</b>	753 (-)-Epigallocatechin 3-gallate (mg) [Flavan-3-ols]
<b>dr1i_fl755</b>	<b>dr2i_fl755</b>	755 Theaflavin (mg) [Flavan-3-ols]
<b>dr1i_fl756</b>	<b>dr2i_fl756</b>	756 Thearubigins (mg) [Flavan-3-ols]
<b>dr1i_fl758</b>	<b>dr2i_fl758</b>	758 Eriodictyol (mg) [Flavanones]
<b>dr1i_fl759</b>	<b>dr2i_fl759</b>	759 Hesperetin (mg) [Flavanones]
<b>dr1i_fl762</b>	<b>dr2i_fl762</b>	762 Naringenin (mg) [Flavanones]
<b>dr1i_fl770</b>	<b>dr2i_fl770</b>	770 Apigenin (mg) [Flavones]

<i>Day 1 variable name</i>	<i>Day 2 variable name</i>	<i>Description<sup>1</sup></i>
<b>dr1i_fl773</b>	<b>dr2i_fl773</b>	773 Luteolin (mg) [Flavones]
<b>dr1i_fl785</b>	<b>dr2i_fl785</b>	785 Isorhamnetin (mg) [Flavonols]
<b>dr1i_fl786</b>	<b>dr2i_fl786</b>	786 Kaempferol (mg) [Flavonols]
<b>dr1i_fl788</b>	<b>dr2i_fl788</b>	788 Myricetin (mg) [Flavonols]
<b>dr1i_fl789</b>	<b>dr2i_fl789</b>	789 Quercetin (mg) [Flavonols]
<b>dr1i_fl791</b>	<b>dr2i_fl791</b>	791 Theaflavin-3,3'-digallate (mg) [Flavan-3-ols]
<b>dr1i_fl792</b>	<b>dr2i_fl792</b>	792 Theaflavin-3'-gallate (mg) [Flavan-3-ols]
<b>dr1i_fl793</b>	<b>dr2i_fl793</b>	793 Theaflavin-3-gallate (mg) [Flavan-3-ols]
<b>dr1i_fl794</b>	<b>dr2i_fl794</b>	794 (+)-Gallocatechin (mg) [Flavan-3-ols]
<b>dr1i_fl_iso</b>	<b>dr2i_fl_iso</b>	Flavonoid totals: Isoflavones (mg)
<b>dr1i_fl_antho</b>	<b>dr2i_fl_antho</b>	Flavonoid totals: Anthocyanidins (mg)
<b>dr1i_fl_3_ols</b>	<b>dr2i_fl_3_ols</b>	Flavonoid totals: Flavan-3-ols (mg)
<b>dr1i_fl_nones</b>	<b>dr2i_fl_nones</b>	Flavonoid totals: Flavanones (mg)
<b>dr1i_fl_ones</b>	<b>dr2i_fl_ones</b>	Flavonoid totals: Flavones (mg)
<b>dr1i_fl_ols</b>	<b>dr2i_fl_ols</b>	Flavonoid totals: Flavonols (mg)
<b>dr1i_fl_total</b>	<b>dr2i_fl_total</b>	Flavonoid totals: Sum of all 29 individual flavonoids (mg)

<sup>1</sup>For individual flavonoids, the “Description” column includes the nutrient code, flavonoid description, unit of measure in parentheses, and flavonoid class in square brackets.

**Table 9. Variables in the Flavonoid Intake Total Nutrient Files (“per day” files)**

<i>Day 1 variable name</i>	<i>Day 2 variable name</i>	<i>Description<sup>1</sup></i>
<b>seqn</b>	<b>seqn</b>	Respondent sequence number
<b>dr1drstz</b>	<b>dr2drstz</b>	Dietary recall status
<b>dr1 t_fl710</b>	<b>dr2 t_fl710</b>	710 Daidzein (mg) [Isoflavones]
<b>dr1 t_fl711</b>	<b>dr2 t_fl711</b>	711 Genistein (mg) [Isoflavones]
<b>dr1 t_fl712</b>	<b>dr2 t_fl712</b>	712 Glycitein (mg) [Isoflavones]
<b>dr1 t_fl731</b>	<b>dr2 t_fl731</b>	731 Cyanidin (mg) [Anthocyanidins]
<b>dr1 t_fl740</b>	<b>dr2 t_fl740</b>	740 Petunidin (mg) [Anthocyanidins]
<b>dr1 t_fl741</b>	<b>dr2 t_fl741</b>	741 Delphinidin (mg) [Anthocyanidins]
<b>dr1 t_fl742</b>	<b>dr2 t_fl742</b>	742 Malvidin (mg) [Anthocyanidins]
<b>dr1 t_fl743</b>	<b>dr2 t_fl743</b>	743 Pelargonidin (mg) [Anthocyanidins]
<b>dr1 t_fl745</b>	<b>dr2 t_fl745</b>	745 Peonidin (mg) [Anthocyanidins]
<b>dr1 t_fl749</b>	<b>dr2 t_fl749</b>	749 (+)-Catechin (mg) [Flavan-3-ols]
<b>dr1 t_fl750</b>	<b>dr2 t_fl750</b>	750 (-)-Epigallocatechin (mg) [Flavan-3-ols]
<b>dr1 t_fl751</b>	<b>dr2 t_fl751</b>	751 (-)-Epicatechin (mg) [Flavan-3-ols]
<b>dr1 t_fl752</b>	<b>dr2 t_fl752</b>	752 (-)-Epicatechin 3-gallate (mg) [Flavan-3-ols]
<b>dr1 t_fl753</b>	<b>dr2 t_fl753</b>	753 (-)-Epigallocatechin 3-gallate (mg) [Flavan-3-ols]
<b>dr1 t_fl755</b>	<b>dr2 t_fl755</b>	755 Theaflavin (mg) [Flavan-3-ols]
<b>dr1 t_fl756</b>	<b>dr2 t_fl756</b>	756 Thearubigins (mg) [Flavan-3-ols]
<b>dr1 t_fl758</b>	<b>dr2 t_fl758</b>	758 Eriodictyol (mg) [Flavanones]
<b>dr1 t_fl759</b>	<b>dr2 t_fl759</b>	759 Hesperetin (mg) [Flavanones]
<b>dr1 t_fl762</b>	<b>dr2 t_fl762</b>	762 Naringenin (mg) [Flavanones]
<b>dr1 t_fl770</b>	<b>dr2 t_fl770</b>	770 Apigenin (mg) [Flavones]
<b>dr1 t_fl773</b>	<b>dr2 t_fl773</b>	773 Luteolin (mg) [Flavones]
<b>dr1 t_fl785</b>	<b>dr2 t_fl785</b>	785 Isorhamnetin (mg) [Flavonols]
<b>dr1 t_fl786</b>	<b>dr2 t_fl786</b>	786 Kaempferol (mg) [Flavonols]
<b>dr1 t_fl788</b>	<b>dr2 t_fl788</b>	788 Myricetin (mg) [Flavonols]

<i>Day 1 variable name</i>	<i>Day 2 variable name</i>	<i>Description<sup>1</sup></i>
<b>dr1 t_fl789</b>	<b>dr2 t_fl789</b>	789 Quercetin (mg) [Flavonols]
<b>dr1 t_fl791</b>	<b>dr2 t_fl791</b>	791 Theaflavin-3,3'-digallate (mg) [Flavan-3-ols]
<b>dr1 t_fl792</b>	<b>dr2 t_fl792</b>	792 Theaflavin-3'-gallate (mg) [Flavan-3-ols]
<b>dr1 t_fl793</b>	<b>dr2 t_fl793</b>	793 Theaflavin-3-gallate (mg) [Flavan-3-ols]
<b>dr1 t_fl794</b>	<b>dr2 t_fl794</b>	794 (+)-Gallocatechin (mg) [Flavan-3-ols]
<b>dr1 t_fl_iso</b>	<b>dr2 t_fl_iso</b>	Flavonoid totals: Isoflavones (mg)
<b>dr1 t_fl_antho</b>	<b>dr2 t_fl_antho</b>	Flavonoid totals: Anthocyanidins (mg)
<b>dr1 t_fl_3_ols</b>	<b>dr2 t_fl_3_ols</b>	Flavonoid totals: Flavan-3-ols (mg)
<b>dr1 t_fl_nones</b>	<b>dr2 t_fl_nones</b>	Flavonoid totals: Flavanones (mg)
<b>dr1 t_fl_ones</b>	<b>dr2 t_fl_ones</b>	Flavonoid totals: Flavones (mg)
<b>dr1 t_fl_ols</b>	<b>dr2 t_fl_ols</b>	Flavonoid totals: Flavonols (mg)
<b>dr1 t_fl_total</b>	<b>dr2 t_fl_total</b>	Flavonoid totals: Sum of all 29 individual flavonoids (mg)

<sup>1</sup>For individual flavonoids, the “Description” column includes the nutrient code, flavonoid description, unit of measure in parentheses, and flavonoid class in square brackets.



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