Appendix 11

Nutrient Information

This appendix contains definitions and units of the nutrients, nutrient ratios and other food components included in the NCC Food and Nutrient Database.

Calories

Calories are a measure of food energy and are expressed in kilocalories or kilojoules. Published values, including those in the USDA nutrient database, usually are calculated values derived from general or specific fuel factors based on Atwater coefficients. Food manufacturers most commonly apply only the general energy factors to calculate calorie content for the product label, although other methods are allowed including use of the specific Atwater factors, general factors with subtraction of insoluble dietary fiber, specific factors approved by the FDA, or bomb calorimetry. The general Atwater factors of 4 kcal/g protein, 9 kcal/g fat, 4 kcal/g carbohydrate, and 7 kcal/g alcohol are applied to all foods regardless of their type, while specific Atwater factors vary by food group. Examples of specific energy factors used for major groups of food are shown below:

	Protein factor kcal/g	Fat factor kcal/g	CHO factor kcal/g
Meat, fish, poultry	4.27	9.02	-
Eggs	4.36	9.02	-
Dairy products	4.27	8.79	3.87
Fats, animal	-	8.93	-
Cereals	3.91	8.37	4.12
Legumes and nuts	3.47	8.37	4.07
Vegetables	2.62	8.37	3.90
Fruits	3.36	8.37	3.60
Sugars	-	-	3.87
Fats, vegetable	-	8.84	-

Kilocalories can be converted to kilojoules (kJ) using the following: *kJ = 4.184 x kcal*

Proximate Nutrients

Total Fat

Total Fat is a mixture of triglycerides, phospholipids, sterols and similar compounds. Values are determined by chemical analyses and are expressed in grams.

Total Carbohydrate

Total Carbohydrate values are calculated per 100 gm as the difference between 100 and the sum of the percentages of water, protein, fat, ash and alcohol. Total carbohydrate is approximately equal to the sum of available carbohydrates (starch and sugars) and dietary fiber. Values are expressed in grams.

Available Carbohydrate

Available carbohydrate includes sugars and starches and is calculated as the difference between total carbohydrate and dietary fiber for most foods. (For foods containing large amounts of organic acids, such as citric acid in powdered drink mixes, available carbohydrate is calculated as the sum of sugars and starch.) Values are reported in grams. *Available Carbohydrate = Total Carbohydrate – Total Dietary Fiber*.

Total Protein

Protein values are calculated from total nitrogen content adjusted for non-protein nitrogen times a conversion factor specific for each food group. Values are expressed in grams.

Nitrogen

Since the protein content of foods is calculated from total nitrogen multiplied by a nitrogen conversion factor, the nitrogen content of a food can be determined by reversing the calculation:

g nitrogen = g protein/nitrogen conversion factor

Nitrogen conversion factors specific to many foods or food groups are available in the food description file of the USDA National Nutrient Database for Standard Reference. The original source of these factors is the *USDA Circular 83: Factors for converting percentages of nitrogen in foods and feeds into percentages of protein*, by D.B. Jones, 1941. For foods that do not have a specific factor assigned by USDA, the general factor of 6.25 is used. Nitrogen is reported in grams in the NDSR database.

Gluten

Gluten values are calculated from plant protein of an overt source of gluten using the Factor 0.75. Values are expressed in grams.

g gluten = g vegetable protein/gluten factor.

Grains in the NCC database considered to contain plant protein that is an overt source of gluten include: barley, bulgur, couscous, kamut, wheat and rye and their by-products.

Note: Foods with "zero" values are not necessarily gluten-free and may not meet the FDA definition of gluten free (<20 parts per million of gluten) because of the process used to determine the nutrient composition for food products in the database. Consequently, gluten values from NDSR may not be appropriate for use in determining whether a food or diet is gluten-free. However, the gluten values may be useful in determining whether a diet or food is low or limited in gluten.

Alcohol

Alcohol volume is converted to weight by use of conversion factors based on the specific gravity of alcohol. Amounts are expressed in grams.

Ash

Ash is a measure of the residue remaining after oxidation of a food in a bomb calorimeter. It contains some, but not all, of the minerals in the food. Values are expressed in grams.

Water

Water values are either obtained from chemical analyses or the difference between 100 percent and the sum of the percentages of protein, fat, total carbohydrate, ash, and alcohol. Values are expressed in grams.

Fat Components

Fatty Acids

Fatty Acids are grouped as saturated (no double bonds), monounsaturated (one double bond), and polyunsaturated (two or more double bonds). Values do not include the glycerol portion of the triglyceride or other fat related compounds. Therefore, the sum of fatty acids is less than the total fat in the food. Fatty acids are expressed by number rather than by scientific name (e.g., 18:1). The first number refers to the number of carbon atoms in the fatty acid chain; the second number refers to the number of double bonds between carbon atoms. Fatty acid values include all positional and geometric isomers of the fatty acid. Values in the database are in grams (subset of total fat).

Trans-fatty Acids

Trans-fatty Acids are geometrical isomers of unsaturated fatty acids in which double bonds are converted from *cis* isomers, where hydrogen atoms are aligned on the same side of the carbon chain, to *trans* isomers where the hydrogen atoms are oriented on opposite sides. This transformation occurs most frequently during hydrogenation of vegetable oils to create solid or semi-solid fats. The database includes 16:1 *trans*, 18:1 *trans*, 18:2 *trans* (*trans*-*cis*, *cis*-*trans*, and *trans*-*trans*) and total *trans*-fatty acids. Values are in grams (subset of fatty acids).

Omega-3 Fatty Acids

Omega-3 Fatty Acids are polyunsaturated fatty acids whose first double bond occurs three carbon atoms from the methyl carbon. They include fatty acids 18:3 n-3, 18:4, 20:5, 22:5, and 22:6 (subset of fatty acids).

Conjugated Linoleic Acids (CLA)

Conjugated linoleic acids (CLA) are fatty acid isomers of linoleic acid (18:2) with the two double bonds separated by a single carbon bond. More than a dozen isomers of CLA have been detected in foods. The most common with known physiological importance are CLA c9,t11 and CLA t10,c12, comprising 80-90% and 3-5% of total CLA respectively. Although CLA contains a *trans* linkage, it is not considered a *trans* fatty acid for food labeling purposes because it does not cause the adverse health effects attributed to non-conjugated *trans* fatty acids. CLA occurs mainly in meat and dairy products derived from ruminants. The NDSR database contains values in grams for total CLA and the two isomers: c9,t11 and t10,c12 (subset of fatty acids).

Solid Fats

Solid Fats are fats naturally present in meat, poultry, eggs, and dairy (lard, tallow, and butter); hydrogenated or partially hydrogenated oils; shortening, palm, palm kernel and coconut oils; fats naturally present in coconut meat and cocoa butter; and 50% of fat present in stick and tub margarines and margarine spreads. Solid Fats values in NCC database were determined based on the methodology and user guide of USDA Food Patterns Equivalents Database 2009-2010. Solid Fats values for multi-ingredient foods in the database were determined based on the amount of these solid fat foods in product formulations or home-prepared recipes. Values are in grams.

Carbohydrate Fractions

Sucrose

Sucrose is a disaccharide composed of glucose and fructose moieties. Sucrose values include sucrose used as an ingredient in manufactured foods and recipes as well as naturally-occurring sugars. Due to inversion which may occur during storage, sucrose values were selected for foods stored under normal conditions and time periods. Values are expressed in grams.

Other Simple Sugars

- Galactose
- Glucose
- Fructose
- Lactose
- Maltose

All values are expressed in grams and include both natural and added sources.

Total Sugars

Total Sugars contains the individual monosaccharides (glucose, fructose and galactose) and disaccharides (sucrose, lactose and maltose). Values are in grams.

Added Sugars (by Available Carbohydrate)

Added Sugars (by Available Carbohydrate) are those sugars and syrups added to foods during food preparation or commercial food processing. They do not include mono- and disaccharides occurring naturally in foods, such as lactose in milk or fructose in fruit. Ingredients designated as "added sugar" foods in the NCC database include: white sugar (sucrose), brown sugar, powdered sugar, honey, molasses, pancake syrup, corn syrups, high fructose corn syrups, invert sugar, invert syrup, malt extract, malt syrup, fructose, glucose (dextrose), galactose, and lactose. The Added Sugars (by Available Carbohydrate) value assigned by NCC to each of these "added sugar" foods is equal to its available carbohydrate value. Added Sugars (by Available Carbohydrate) values for other foods in the database were determined based on the amount of these designated ingredients contained in product formulations or home-prepared recipes. Values are in grams.

Note: Because the Added Sugars (by Available Carbohydrate) value assigned by NCC to each of the above foods is equal to its available carbohydrate value, the result may be that the gram amount of Added Sugars (by Available Carbohydrate) in a food exceeds the gram amount of total sugars in that food.

Added Sugars (by Total Sugars)

Added Sugars (by Total Sugars) are those sugars and syrups added to foods during food preparation or commercial food processing. They do not include mono- and disaccharides occurring naturally in foods, such as lactose in milk or fructose in fruit. Ingredients designated as "added sugar" foods in the NCC database and in accordance with the 2010 Dietary Guidelines for Americans include: white sugar (sucrose), brown sugar, powdered sugar, honey, molasses, pancake syrup, corn syrups, high fructose corn syrups, invert sugar, invert syrup, malt extract, malt syrup, fructose, glucose (dextrose), galactose, and lactose. The Added Sugars (by Total Sugars) value assigned by NCC to each of these "added sugar" foods is equal to its total sugars value. Added Sugars (by Total Sugars) values for other foods in the database were determined based on the amount of these designated ingredients contained in product formulations or home-prepared recipes. Values are in grams.

Sugar Alcohols

Sugar alcohols (also known as polyols) are a class of nutritive sweeteners derived from sugars by hydrogenation of the sugar molecule. They are less sweet than sugar and also provide fewer calories, between 1.6 to 3.0 calories per gram. Some occur naturally in foods, while others are produced only through commercial development and added as sweeteners to food products. The NDSR database contains nine sugar alcohols reported in gram amounts:

- Erythritol
- Inositol
- Isomalt
- Lactitol
- Maltitol
- Mannitol
- Pinitol
- Sorbitol
- Xylitol

Starch

Starch includes dextrins and glycogen. Values are in grams.

Total Dietary Fiber

Total Dietary Fiber includes unavailable carbohydrates (cellulose, hemi-cellulose, pectins, gums, and muscilages) and lignin. Values are obtained by chemical analyses or from the sum of insoluble dietary fiber and soluble dietary fiber. Values are expressed in grams.

Insoluble Dietary Fiber

Insoluble Dietary Fiber is the portion of dietary fiber determined by the modified Van Soest neutral detergent method. This includes cellulose, some hemicellulose, and lignin. Values are in grams.

Soluble Dietary Fiber

Soluble Dietary Fiber values are determined by chemical analyses or calculated from the difference between total dietary fiber and insoluble dietary fiber. It includes pectins, gums, muscilages and some hemicellulose. Values are in grams.

Pectins

Pectins are included in soluble dietary fiber. Values are obtained from chemical analyses and are given in grams.

Protein Components

Animal Protein

Animal Protein is protein from animal products, including meats, eggs and dairy foods. Values are given in grams.

Vegetable Protein

Vegetable Protein is the amount of protein contributed by plant products and is expressed in grams. The sum of animal and vegetable protein in a food equals the total protein of that food.

Amino Acids

Amino Acids are organic acids that are the basic components of protein. They are determined by chromatographic or microbiological methods. Values include both protein-bound and free forms and are expressed in grams. Eighteen amino acids are presented; the field for cystine includes cysteine as well.

3-Methylhistidine

3-Methylhistidine (3MH) is an amino acid found in both protein-bound and soluble forms in animal tissue. The NCC database contains values for only protein-bound 3MH which is given in milligrams. Protein-bound 3MH is found at very consistent levels in the skeletal muscles of a wide variety of species and is only found in muscular protein tissue.

Vitamins

Vitamin A

Vitamin A includes preformed vitamin A (retinol) and provitamin A carotenoids expressed as beta-carotene activity. International Units (IU) or Retinol Equivalents (RE) have been traditionally used to describe total vitamin A activity. A more recent definition, Retinol Activity Equivalents (RAE), reduces by half the vitamin A activity of the carotenoids.

Vitamin A values are analyzed or are calculated from the following:

IU Vitamin A = (mcg retinol/0.3) + (mcg beta-carotene equivalents/0.6)

RE Vitamin A = mcg retinol + (mcg beta-carotene equivalents/6)

RAE Vitamin A = mcg retinol + (mcg beta-carotene equivalents/12)

Retinol is preformed vitamin A found only in animal products. Values are given in micrograms. 1 mcg retinol provides 1 RE (or RAE) vitamin A or 3.33 I.U. vitamin A.

Beta Carotene Equivalents

Beta carotene equivalents include vitamin A activity from the provitamin A carotenoids: beta-carotene, alpha-carotene, and beta-cryptoxanthin. Beta-carotene equivalents are calculated from the following: *mcg beta-carotene equivalents = mcg beta-carotene + ½(mcg alpha-carotene + mcg beta-cryptoxanthin)*

Values are expressed in micrograms. 6 mcg beta-carotene equivalents provide 0.5 RAE vitamin A, 1 RE vitamin A, or 10 I.U. vitamin A.

Carotenoids

Carotenoids included in the database are alpha-carotene, beta-carotene, beta-cryptoxanthin, lutein+zeaxanthin, and lycopene. Primary food sources are fruits and vegetables. Only plants have the ability to synthesize carotenoids, but animals can utilize them from their feed and store them in their tissues. Carotenoids also may be added to foods for coloration purposes. Alpha-carotene, beta-carotene, and beta-cryptoxanthin are vitamin A precursors, with beta-carotene yielding twice the vitamin A activity of the other two provitamin A carotenoids. Carotenoid values are given in micrograms.

Vitamin E (total alpha-tocopherol)

In accord with the definition of vitamin E in the Institute of Medicine report: *Dietary Reference Intakes for Vitamin C, Vitamin E, Selenium, and Carotenoids, 2000*, Vitamin E (total alpha-tocopherol) includes the following forms of alpha-tocopherol only:

RRR-alpha-tocopherol, the form of alpha-tocopherol that occurs naturally in food, and

2-*R*-stereoisomeric forms of alpha-tocopherol that occur in fortified foods and supplements

Synthetic alpha-tocopherol used in fortified foods and supplements provides less than half of the vitamin E activity as the natural form of alpha-tocopherol.

mg vitamin E (total alpha-tocopherol) = mg natural alpha-tocopherol + (mg synthetic alpha-tocopherol x 0.45)

Many fortified foods and supplements continue to label vitamin E in international units (IU), where 0.67 mg of natural alpha-tocopherol or 1.0 mg of synthetic alpha-tocopherol equals 1 IU of vitamin E.

vitamin E (IU) = (mg natural alpha-tocopherol/0.67) + (mg synthetic alpha-tocopherol/1.0)

Vitamin E (total alpha-tocopherol) is expressed in milligrams.

Natural Alpha-tocopherol

Natural alpha-tocopherol, also called d-α-tocopherol or RRR-α-tocopherol, is the form of alpha-tocopherol that occurs naturally in foods. It is expressed in milligrams.

mg natural alpha-tocopherol = IU vitamin E x 0.67

Synthetic Alpha-tocopherol

Synthetic alpha-tocopherol, also called dl-α-tocopherol or all-rac-α-tocopherol, includes eight stereoisomers of alpha-tocopherol in equal amounts. Only four of these isomers are in the 2-R-stereoisomeric form and are biologically active as vitamin E. Synthetic vitamin E also may be listed on the label of fortified foods or supplements as dl-α-tocopheryl acetate or dl-α-tocopheryl succinate. In the NDSR, values for synthetic alpha-tocopherol are as milligrams.

1 mg synthetic alpha-tocopherol = 1 IU vitamin E = 0.45 mg vitamin E

Total Alpha-tocopherol Equivalents

Total alpha-tocopherol equivalents (α-TE) are determined from alpha-, beta-, gamma-, and delta-tocopherols and previously was used as the measure of vitamin E activity. Currently only alpha-tocopherol is recognized as contributing to vitamin E. Because the other naturally occurring tocopherols are not converted to alpha-tocopherol in humans, they are no longer used to determine vitamin E activity. α-TE values continue to be maintained in the database for studies that still want to use them as a vitamin E measure or want to compare current data with α-TE values used in the past. α-TE values are expressed in milligrams.

mg α-TE = mg natural alpha-tocopherol + (0.4 x mg beta-tocopherol) + (0.1 x mg gamma-tocopherol) + (0.01 x mg delta-tocopherol) + mg synthetic alpha-tocopherol

The Third National Health and Examination Survey (NHANES III) estimated that 80 percent of the α-TE from foods in the survey was alpha-tocopherol (*Dietary Reference Intakes for Vitamin C, Vitamin E, Selenium, and Carotenoids*, 2000). Therefore to estimate the milligrams of vitamin E (total alpha-tocopherol) from α-TE values of daily diets typical in the United States, the following factor may be used: *mg vitamin E (total alpha-tocopherol) in a meal = mg α-TE in a meal x 0.8*

Vitamin K

Vitamin K values are for vitamin K1 (phylloquinone) which is found in natural food sources, but do not include vitamin K2 (menaquinone), the form synthesized by bacteria in the human intestines. Generally, values are those derived by high-performance liquid chromatography and are reported in micrograms.

Vitamin D

Vitamin D includes total calciferols Vitamin D2 (ergocalciferol) and Vitamin D3 (cholecalciferol). Values are expressed in micrograms.

0.025 mcg vitamin D = 1 I.U.

Vitamin D2

Vitamin D2 includes ergocalciferol expressed in micrograms.

Vitamin D3

Vitamin D3 includes cholecalciferol expressed in micrograms.

Vitamin C

Vitamin C represents total vitamin C expressed as the activity of reduced ascorbic acid. Values are in milligrams.

Thiamin

Thiamin (also known as vitamin B1) includes both bound and free forms and is expressed in milligrams.

Riboflavin

Riboflavin (also known as vitamin B2) includes both bound and free forms. Values are in milligrams.

Niacin

Niacin includes bound and free forms. Values do not include amounts that could be contributed by the precursor, tryptophan. Amounts are given in milligrams.

Niacin Equivalents (NE) include the amount of niacin provided by the conversion of tryptophan to niacin, and also are expressed in milligrams. Niacin equivalents are calculated by the following: *mg NE = mg niacin + (mg tryptophan/60)*

Pantothenic Acid

Pantothenic acid values include both free and bound forms which have been determined by microbial assay or radioimmunoassay. They are expressed in milligrams.

Vitamin B6

Vitamin B6 includes three forms, pyridoxine, pyridoxal and pyridoxamine. Values are determined microbiologically or by liquid chromatography and are expressed in milligrams.

Vitamin B12

Vitamin B12 occurs in several forms designated as cobalamin. Values are generally those obtained by assay with *L. leichmanni*. Vitamin B12 is found only in animal products. Values are expressed in micrograms.

Folate

Total Folate consists of a group of biologically active compounds, pteroylglutamic acid (PGA) and its derivatives. Values include all forms of natural PGA, both bound and free, as well as synthetic folic acid. Values selected are those measured with *L. casei* using conjugase treatment for release of bound forms and ascorbic acid for protection from oxidation. Amounts are given in micrograms.

Natural Folate is that which occurs naturally in foods, usually as pteroylpolyglutamates.

Synthetic Folate is in the form of folic acid (pteroylmonoglutamic acid) and is used in fortified foods and vitamin supplements.
Dietary Folate Equivalents (DFE) are units that account for differences in absorption between natural folate and synthetic folate and are calculated as follows:

For folate occurring in food: *mcg DFE = mcg natural folate + (1.7 x mcg synthetic folate)*

For folate occurring in dietary supplements: *mcg DFE = 2 x mcg synthetic folate*

Minerals

Minerals values represent the total amount in a food, although not all may be available to the body. The values generally do not include minerals present in tap water used to prepare a product.

Calcium

Calcium values are in milligrams.

Phosphorus

Phosphorus values are in milligrams.

Magnesium

Magnesium values are in milligrams.

Manganese

Manganese values are in milligrams.

Iron

Iron includes both heme and non-heme iron and is expressed in milligrams.

Zinc

Zinc values are in milligrams.

Copper

Copper values are in milligrams.

Selenium

Selenium values are given in micrograms. Values were selected that represent foods grown in locations where neither excesses nor deficiencies of selenium are evident.

Sodium

Sodium includes naturally occurring sodium in foods as well as that added during food processing. It does not include sodium from salt added at the table. Sodium values are in milligrams.

Potassium

Potassium values are in milligrams.

Nutrient Ratios

% Calories

The percent of calories contributed by each macronutrient (protein, fat, carbohydrate, alcohol) is calculated by the NDSR software using the following method:

1. Energy factors (e.g., general or specific Atwater factors) for each macronutrient and specific to each individual core food are incorporated into the database.

2. The gram weight of each macronutrient for each food is multiplied by its energy factor to determine the calories provided by each macronutrient for that food.

3. The calories contributed by each macronutrient are summed for all foods in the diet.

4. The total calories per macronutrient are divided by the total calories in the diet and multiplied by 100 to equal the percent calories contributed by each macronutrient.

This method, beginning with NDSR 2008, provides the most accurate measure of both total calories and percent of calories from each macronutrient.

Polyunsaturated to Saturated Fat Ratio

The P/S ratio is calculated from values of total polyunsaturated fatty acids and total saturated fatty acid: *P/S = g PUFA/g SFA*

Cholesterol to Saturated Fatty Acid Index

The CSI was developed to classify foods by their contribution of cholesterol and saturated fat, both risk factors for heart disease (S.L. Connor and W.E. Connor, *The New American Diet*, 1986). *The CSI is determined as 1.01(g SFA) + 0.05(mg cholesterol)*. A lower CSI indicates the food is a "better choice for the prevention of heart disease".

Glycemic Index

Glycemic index (GI) is a ranking of carbohydrate foods based on their effect on postprandial glycemia compared with the effect produced by a reference food, either glucose or white bread. GI is determined by an *in vivo* test in which subjects consume a test food containing 50g of available carbohydrate. Blood glucose levels after 2 hours are expressed as a percent of the glucose response in the same subject after consumption of 50g of available carbohydrate from the reference food. Foods with a GI (glucose reference) of 55 or less are classified as low glycemic foods, those with a GI of 70 or above are high glycemic foods, and those in between 55 and 70 are medium glycemic foods. GI values obtained when white bread is used as the standard are 1.43 times those obtained when glucose is the standard. GI values for daily totals, recipes and formulations in the NDSR are calculated from the GI and weighted by available carbohydrate of each ingredient food. For foods where measured GI data were unavailable in the literature, GI was either estimated from similar foods, calculated from available carbohydrate amounts and the GI of ingredients within the food, or given a default GI. Methodology for selection of GI values and their incorporation into the database was similar to that reported by Flood et al. in Methodology for Adding Glycemic Load Values to the National Cancer Institute Diet History Questionnaire Database. *J Am Diet Assoc*, 2006; 106:393-402.

The following steps are used to calculate the GI for a food from its ingredients:

- *Sum available carbohydrate (ACHO) values of all ingredients: Σ ingredient ACHO) = food ACHO*
- *Calculate the proportion of available carbohydrate contributed by each ingredient: (ingredient ACHO/ ACHO total for food) = ingredient proportion of ACHO*
- *For each ingredient, multiply the proportion of ingredient available carbohydrate by the ingredient glycemic index: ingredient proportion of ACHO X ingredient GI = proportional GI*
- *Sum the proportional GI values: Σ (ingredient proportional GI) = food GI*

This method has limitations in that factors that may influence GI, such as levels and type of protein and fat, and food processing cannot be accounted for in the calculation.

The following example illustrates calculation of the GI for a food (cheese pizza mix) from its ingredients:

Cheese Pizza Mix (1 package): The GI for this food is 70.40.

Ingredient	**ACHO (g)**	**Proportion of total ACHO**	**Ingredient GI (glucose reference)**	**Proportional GI (proportion of total ACHO X ingredient GI)**
Tomato sauce	29.15	0.1878	74	13.90
Flour	124.56	0.8023	70	56.16
Parmesan cheese	1.54	0.0099	34	0.34
Salt	0	0.000	0	0
Total for Food	**155.25**	**1.0000**		**70.40**

Glycemic Load

Glycemic load (GL) quantifies the glycemic effect of a food portion. For example, foods with a high glycemic index may be consumed in small enough portions that only a small glycemic response is produced. This effect is measured as glycemic load and is calculated as follows: (*food ACHO X food GI/100) = food GL*. Glycemic load is calculated for a recipe or formulation, a meal, or a daily diet by summing the GL of the individual ingredients within the recipe or formulation or the GL of foods within a meal or daily diet.

The following steps are used to calculate glycemic load for a food:

- *Multiply the available carbohydrate (ACHO) of each ingredient by the ingredient GI/100: ingredient ACHO X ingredient GI/100 = ingredient GL*
- *Sum the ingredient GL: Σ (ingredient GL/100) = food GL*

The following example calculates the GL for a BLT sandwich from its ingredients.

BLT Sandwich: The GL for the sandwich is 18.61.

Ingredient	Amount	ACHO (g) per amount	Ingredient GI (glucose reference)	GL per ingredient amount (ACHO per amount X ingredient GI/100)
White bread	2 med slices	24.10	73	17.59
Lettuce	1 med leaf	0.14	50	0.07
Tomato	2 med slices	1.09	50	0.54
Bacon	3 strips	0.34	28	0.10
Mayo Type	1 Tb	0.54	57	0.31
Total				**18.61**

Other Food Components

Cholesterol

Cholesterol is a sterol associated with animal fats. It is generally not found in plant products. Values are expressed in milligrams.

Isoflavones

The isoflavones are a class of phytoestrogens found in plant sources, especially soybeans and soy foods. Daidzein, genistein, and glycitein are the predominant isoflavones in food. Isoflavones derivatives, biochanin A and formonontein, metabolize to genistein and daidzein respectively in the gut. Coumestrol, although not an isoflavone, is a phytoestrogen similar in structure. Isoflavones can occur in foods in the free form (aglycone) or as glucoside conjugates. Values in the database have been converted to milligrams of the free form (aglycone) of the isoflavone.

Acesulfame Potassium

Acesulfame potassium or acesulfame-K is a non-nutritive sweetener that is the potassium salt of 6-methyl-1,2,3-oxathiazin-4(3H)-one-2,2 dioxide. It is sold under the name Sunett™ or as the tabletop sweetener Sweet One™. Database values are in milligrams.

Aspartame

Aspartame is a nutritive synthetic sweetener consisting of the amino acids phenylalanine and aspartic acid, and a small amount of methanol. It is marketed as NutraSweet™. Values are presented in milligrams.

Saccharin

Saccharin is a non-nutritive artificial sweetener with the chemical formula C6H4SO2 NHCO. It is expressed in milligrams.

Sucralose

Sucralose is a non-nutritive sweetener made from sugar that is modified by selective chlorination to intensify its sweetness and prevent its metabolism. It is marketed under the brand name Splenda™. Values in the database are expressed in milligrams.

Sucrose Polyester

Sucrose polyester is a calorie-free fat substitute. It is synthesized by reacting six, seven, or eight fatty acids with the hydroxyl groups of sucrose. It is marketed under the name Olestra™ or Olean™. Values in the database are in grams.

Tagatose

Tagatose is a low calorie nutritive sweetener that occurs naturally in small amounts in dairy products. As an ingredient in commercial food products, it is manufactured from lactose by isomerization of galactose and marketed under the trade name Naturlose™. Tagatose provides 38% the calories of sucrose. Values in the database are in milligrams.

Caffeine

Caffeine is given in milligrams. Values do not include theobromine. The caffeine value for brewed coffee represents weighted averages of automatic drip and percolated values provided by the USDA database.

Phytic Acid

Phytic acid (myo-inositol hexakisphosphate, IP6) is a naturally occurring plant constituent that functions as the storage form of phosphorous for the germinating seed. It is an inositol phosphate consisting of a ring of six phosphate ester groups. It is expressed in milligrams in the database.

Oxalic Acid

Oxalic acid is a dicarboxylic acid found in most plant tissues; very little occurs in animal products. It may be present as sodium or potassium salts (soluble oxalate) or as calcium oxalate or other bound forms (insoluble oxalate). Values in the database are in milligrams.

Choline

Choline is an essential nutrient and occurs in foods as free choline, phosphocholine, phosphatidylcholine, glycerophosphocholine and sphingomyelin. Choline in the NDSR database includes all forms of this nutrient and is reported in milligrams.

Betaine

Betaine is a metabolite of choline that is important in the conversion of homocysteine to methionine. The synthesis of betaine from choline cannot be reversed; therefore betaine is not included in total choline amounts. It is a separate nutrient in NDSR and is measured in milligrams.