
INFORMATION TO USERS

This updated version Thai FCTs 2015 contains about 1700 food items, each with the maximum of 27 nutrients. To facilitate and assist in effectively uses of the FCTs, the following provides some information and details about Thai FCD 2015 to the users.

1. Sampling, sample preparation and the number of sample analyses

Information on sampling, sample preparation, and the number of samples analysed are available in published papers (p), research papers (r), and theses (t). A limited amount of information is unpublished laboratory data (u). Detailed information for each data set, where available, was recorded in the archival files. Fresh foods analysed at INMU during 1986 - 1997 were collected according to the ASEANFOODS Sampling Guidelines⁽³¹⁾. Broadly, this requires the collection of 100 - 300 g dry food or 500 - 1000 g fresh food per stall from 10 different markets, which are presumed to supply foods from different parts of the country. The data on fresh foods generated by INMU was mostly obtained from the analysis of 10 single samples or a single composite sample prepared from 10 single samples, whereas the data for cooked foods were obtained from the analysis of 3 single samples. For processed foods, data were obtained from the analysis of a composite sample prepared from 12 representative single samples. Food items analysed during 1997 to 2014 were mostly collected from three retailers per market and from 3 to 6 representative markets in metropolitan Bangkok. A single composite sample from each market was prepared. Thus, three to six single composite samples were analysed for each food item, in duplicate.

2. INFOODS Tagnames^(5, 10)

According to the agreement of the THAIFOODS and ASEANFOODS committees and the ad hoc technical committee for global harmonisation, the INFOODS nutrient Tagnames were recommended to be used for food composition data compilation and interchange. The Tagnames unambiguously indicate how the nutrient data was derived and which methods of analysis were used for the analysed data. If the data was derived by calculation (e.g. CHOAVLDF, carbohydrate, available, calculated by difference), the Tagname indicates which formula was used for the calculation (e.g. CHOAVLDF = 100 g – (weight in grams [water + protein + fat + dietary fibre + ash] in 100 g food). It is recognised that the INFOODS Tagnames, if utilised worldwide, will facilitate international and regional data interchange and harmonisation⁽³²⁾. The INFOODS Tagnames applied in the current FCTs are listed in **Table 2**. They are presented as components of table heading on the first page of the table for each food group.

3. Food identification (Food ID)

Following the same system as used with Thai FCTs 1999 and ASEAN FCTs 2000, an alphanumeric system is used for food identification. Each food item has a unique food ID in the first column. The alphabet character indicates the major food group, while the numeric character represents the record number within the food group. For example, a food item with the food ID 'A1' is translated as follows: 'A' represents food group A, Cereals and their products; and '1' is the number of the food in group A, which in this case is ข้าวกล้อง, พันธุ์หอมมะลิ, ดิบ; Rice, brown, Jasmine variety, raw. This system will assist users in searching through food composition data, especially when searching starts from the English name column in **Appendix 1**. Since the food composition data may be included in the ASEAN FCTs and may be used elsewhere, the country code of Thailand as 'TH' will be included in the Food ID, and the Food ID for each food must be fixed. New food items can be added to the same food group and the names can be rearranged without changing the ID number of previous data. Thus, the numeric character in the food ID does not necessarily indicate the record position of the food item in the food group.

4. Food description

Under the Food and Description column, the food items are alphabetically listed according to their Thai names. The sequence of food descriptors is from generic to specific, i.e. strain, part, process, maturity, and grade are presented. The common English names are given as completely as possible. However, for some food items, such as different varieties of fruits, specific English names cannot be given due to limitations of the scientific names. When the English name is not known, the Thai name is given in English by spelling exactly how the food is called. Scientific names cannot be given for processed foods, since they often consist of several ingredients. To assist international users, food identification (Food ID), English names, scientific names and Thai names are presented together with the page number in **Appendix 1**. The food items are alphabetically arranged according to the English names.

5. Food grouping

The foods are classified into 16 food groups (**Table 4**) and the major types of foods arranged in each food group are also summarised. FCD of raw and cooked foods are presented prior to processed foods in each food group. As explained in Section 1.4, there are no food groups with the letter I, L, O, P or R. It should be noted that fresh spices, such as garlic, holy basil, lemon grass and mint are included in Group N, Spices, herbs, condiments and other seasonings. In addition, Group S includes only franchise fast foods, whereas Thai fast foods and other cooked dishes are presented separately in Group T, Mixed foods. Bakery and snacks are presented as

sub-groups under Group T, Mixed foods. Unconventional protein sources, such as edible insects and food supplements, such as chicken essence and bird's nest, are presented in Group U, Miscellaneous products. Users should note that some foods could be listed in several groups depending on the consumed part of a food, its maturity and its use, as shown in **Table 5**. For example: 1) jackfruit seeds and melon seeds are presented in Group C, whereas their fruits are presented in Group E; 2) raw papaya is categorised in the vegetable group, as it is used for the preparation of papaya salad, whereas its ripe fruit is presented in Group E; 3) mature coconut is presented in Group K, as it is used to prepare coconut milk (the fat source in various kinds of curries), whereas its young tips are placed in Group D (eaten as a vegetable) and its juice in Group Q (Fruit juice).

6. Notes on nutrients and expression of data

FCD included in the Thai FCTs 2015 are energy and 27 nutrients data. They are listed in **Table 1** with standard unit of expression and number of decimal places for each nutrient. Methods for analyses of all nutrients and for calculation of energy, carbohydrate and total vitamin A as retinol activity equivalent (RAE) are listed in **Table 2**, together with INFOODS nutrient tagnames. In the FCTs, the nutrient composition of foods is presented separately into two sections: **Section 1. The Concise Thai Food Composition Tables**, include values of energy and 21 nutrients divided into 4 groups, proximate composition, minerals, vitamins, and other (total sugars; **Section 2. Fatty acids and cholesterol in selected foods** includes water, total fat, and different types of fatty acids: saturated, monounsaturated, polyunsaturated, n-3 polyunsaturated, and n-6 polyunsaturated, of selected foods.

The energy value and nutrient composition of foods in FCTs 2015 are expressed as amounts per 100 g of edible portion. For some selected liquid foods, nutrients are presented per 100 mL. Available data on density are presented in the FCTs of Group F, for milk, Group K, for oil, Group N, for light sauces, and Group Q, for beverage. For these cases, it must be noted that the weight of the liquid food per 100 mL sample must be used in the formula for calculation of total or available carbohydrate by difference, this is because 100 mL of the selected liquid sample does not equal to 100 g.

Table 4. Food codes, food groups, major food types and number of food items in each food group

Food Code	Food group and food type	Food Code	Food group and food type
A	Cereals and their products (78 items): <i>Rice, corn</i> <i>Noodles, instant noodles</i> <i>Flours</i>	H	Eggs and their products (32 items): Eggs: chicken, ducks, quails
B	Starchy roots, tubers and their products: (18 items): Cassava, potato, taro, sweet potato, Flour	J	Milk and its products (49 items): Cow milk and products: yoghurt,
C	Legumes, nuts, seeds and their products (92 items): Dried legume seeds: oil seeds, pulses, Seeds: pumpkin, sesame, sunflower Nuts: cashew nut, macadamia	K	Fats and oils (43 items): Animal fats, vegetable oils Coffee-mate Foods with fat or oil as the major component - mature coconut Oil-based products
D	Vegetables and their products (292 items): Green leafy green Fruit vegetables and flowers Fresh leguminous pods Plant tips (coconut tips) Mushrooms Indigenous vegetables	M	Sugars, syrup and confectionery (9 items): confectionery and sweets
E	Fruits and their products (183 items): Tropical fruits: fresh and dried Preserved fruits: paste, candied, pickles Commercial products	N	Spices, herbs, condiments and other seasonings (81 items): Fresh herbs, pepper, dried chilli Seasonings, sauces Chilli paste, curry paste
F	Meats, other animals and their products (161 items): Meat: beef, pork, poultry and their organs Other animals: frog Processed/Products: meat ball	Q	Beverages: nonalcoholic (30 items): Chocolate drinks Fruit-flavoured drinks Fruit juices Soybean milk
G	Finfish, shellfish, other aquatic animal and their products (236 items): Freshwater and marine fish, shellfish Processed/Products: fermented and other preserved products, household and commercial	S	Fast foods: franchise foods (17 items): sandwiches, doughnuts, meat- burger, pizza
		T	Mixed foods: (314 items): Main dishes: hot and sour spicy soup One-plate dishes: noodle dishes, Desserts Bakery Snacks
		U	Miscellaneous (30 items): Insects Chicken essence, bird's nest Algae

Table 5. Classification of foods according to their parts, maturity and uses

Food items	Group A. Cereals	Group B. Starchy	Group C. Legume....	Group D. Vegetables	Group E. Fruits	Group G. Fishes	Group J. Milk	Group K. Fats...	Group M. Sugars...	Group N. Spice....	Group Q. Beverages	Group T. Mixed dishes
Corn	kernel			young corn								
Glutinous rice	raw, cooked											cooked in coconut milk
Sweet potato, Cassava		head, root, flour		tip, leaf								
Snap bean, yard-long bean, cowpea, winged bean, pea			seeds	Pods								
Jackfruit			seed	young fruit	mature fruit							
Water melon			seed	young fruit	mature fruit							
Rambutan			seed		fruit							
Pumpkin			seed	fruit, young tip								
Tamarind			seed	young pod	mature pod							
Soybean			seed, tofu, soybean paste							sauce		
Coconut				young tip	young coconut			grated, roasted, coconut milk	sugar coated dried coconut		juice	
Papaya				raw fruit	ripe fruit							
Garlic, Ginger, Galanga, Coriander				leaves, flowers						clove, root, seeds, powder		
Chilli				bird chilli, hot pepper sweet pepper						Dried chilli		
Tiny shrimp						meat				paste		
Fish						meat				Fermented fish viscera		
Dairy products							milk, yoghurt, cheese	butter				

Some foods contain negligible amounts of some nutrients or none. Without the analysed values, these nutrients can be presumed to be zero and are shown in the tables as '0p'.

- cholesterol in single plant foods
- β -carotene in white/light coloured single plant foods e.g., grains, cereals, seeds and legumes⁽³³⁾.
- ascorbic acid in single raw and processed animal foods, food combinations, dry legume seeds, nuts, cooked and canned dishes/foods unless fortified⁽³⁵⁾

The symbol 'tr' for trace, indicates that the constituent is present but with an amount below the measurement accuracy of the method. It may be used when the level is judged to be nutritionally insignificant⁽⁷⁾. Some suggestion for trace values for each nutrient is shown in **Table 6**.

The presentation of an amount of nutrient as '0p' and 'tr' can be assigned 'zero' when used in dietary computation.

Missing data, especially for vitamins and trace minerals, are presented as '-' and have not been substituted with borrowed data.

Table 6. Trace values for each nutrient per 100 g edible portion of food⁽⁷⁾

Constituent	Unit	Trace = amount less than
Major constituents (water, protein, fat, carbohydrate, dietary fiber, ash)	g	0.06
Inorganic constituents: calcium, phosphorus, magnesium, sodium, potassium	mg	0.6*
Trace elements: iron, zinc,	mg	0.06
: copper	mg	0.06
Vitamins: A activity, retinol, β -carotene	μ g	0.6
: B1, B2	mg	0.006
: niacin	mg	0.06*
: C	mg	0.6

*modified value from ref. 7, used in Thai FCTs 1999 and ASEAN FCTs 2000

Methods of nutrient analysis

Methods for analysis of nutrients used at INMU are published in ASEAN Manual of Food Analysis⁽¹¹⁾, available on the ASEANFOODS website:

<http://www.inmu.mahidol.ac.th/aseanfoods/publication.html>. Thus, only aspects which could affect the values of nutrients in FCDB and which FCDB users should be aware of are covered here.

Total protein

Total protein values <PROT> generally derive from the total nitrogen content, as determined by Kjeldahl method, multiplied by a specific conversion factor^(7, 34). A factor of 6.25 is generally used for converting total nitrogen to protein, since most proteins contain 16% nitrogen. Specific conversion factors used in Thai FCTs 2015 for certain foods which differ in their percentage of nitrogen are shown in **Table 7**.

For the total protein value, <PROT>, of finfish and their products, a conversion factor of 6.25 was used. Different proportions of non-protein nitrogen, ranging from 1 to 3 g per 100 g were found in different species of fresh fishes, whereas higher values, ranging from 4 - 8 g per 100 g were found in their processed/products, such as sundried, salted and fermented products. 'True protein' <PROCNP>, in selected food items of this food group which calculated from protein nitrogen x 6.25, when available, are presented in parentheses and placed under the total protein figure in the same cell and column in Group G, Finfish and products and in Group N, Seasonings: fish sauces. However, to avoid overestimating carbohydrate (by difference), total protein was used for the calculation of carbohydrate. Food items which data on total protein are not available (available carbohydrate by difference cannot be estimated), values on total sugars of the foods were used for available carbohydrates.

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Table 7. Selected factors for conversion of nitrogen values to protein^(7, 34)

Foods	Conversion factors
Meat and fish	6.25
Milk and milk products	6.38
Human milk	6.37
Eggs, whole	6.25
Rice and rice flour	5.95
Barley and barley flour	5.83
Rye and rye flour	
Oats	
Corn (Maize)	6.25
Wheat, whole-kernel	5.83
Wheat, bran	6.31
Wheat flour, refined	5.70
Wheat endosperm)	
Almonds	5.18
Peanuts, Brazil nuts	5.46
Soybean	5.71
Other nuts (e.g., cashew nut, chestnut, pistachio)	5.30
Seeds (e.g., pumpkin, sesame, sunflower)	
Foods where specific factor is not listed	6.25

Fatty acids

During the past few years, data on fatty acids have been regularly requested by data users. Key data on various fatty acids in selected Thai foods are analysed data at INMU and about 15% are data from MOPH⁽⁴⁾ which have been modified by the same correction factors and presented as combined or standalone in this version in **Section 2**.

Gas-liquid chromatography after saponification of a food sample is the common method for determines fatty acids pattern distributed in fat part of a food⁽¹²⁾. A specific correction factor for each fatty acid in each food^(35, 36) must be applied to correct data of fatty acids analysed as percentage of total fatty acids to the amount in gram per 100 g edible portion. The correction

factors from several references are listed in the Compendium of Methods for food analysis⁽³⁶⁾; the used factors for the Thai FCTs 2015 are given in **Appendix 3**. The fatty acids presented in **Section 2** are values of total fatty acids of 5 main groups which covered 37 main fatty acids in foods as follows:

Total fatty acids	INFOODS Tagnames	Fatty acids included
Omega-3 polyunsaturated	FAPUN3	C18:3 (Linolenic), C18:4, C20:3 (cis-8,11,14-Icosatrienoic), C20:5 (Eicosapentaenoic), C22:5 and C22:6 (Docosahexaenoic).
Omega-6 polyunsaturated	FAPUN6	C18:2 (Linoleic), C18:3 (γ -Linolenic), C20:2 (Icosadienoic), C20:3 (cis-5,8,11-Icosatrienoic) and C20:4 (Arachidonic).
Saturated	FASAT	C6:0 (Caproic), C8:0 (Caprylic), C10:0 (Capric), C12:0 (Lauric), C14:0 (Myristic), C16:0 (Palmitic), C 18:0 (Stearic), C20:0 (Arachidic), C22:0 (Behenic) and C24:0 (Lignoceric).
Monounsaturated	FAMS	C14:1 (Myristoleic), C16:1 (Palmitoleic), C18:1 (Oleic), C20:1 (Icosenoic), C22:1 (Erucic) and C24:1 (Nervonic).
Polyunsaturated	FAPU	C18:2 (Linoleic), C18:3 (Linolenic, γ -Linolenic), C18:4 (Stearidonic), C20:2 (Icosadienoic), C20:3 (cis-8,11,14-Icosatrienoic and cis-5,8,11-Icosatrienoic), C20:4 (Eicosatetraenoic), C20:5 (Eicosapentaenoic), C22:2 (Docosadienoic), C22:5 (Docosapentaenoic) and C22:6 (Docosahexaenoic).

Carbohydrate and energy by calculation

For nutrient data sets of a foods which contain dietary fibre, available carbohydrate by difference <CHOAVLDF> was calculated, otherwise total carbohydrate by difference <CHOCDF> was obtained and presented as 'carbohydrate, total' in parentheses in the same column.

Accordingly, energy values, which include available carbohydrate or total carbohydrate, was calculated and presented in the same way as carbohydrate. See formula for calculation of these values in **Table 2**.

Total sugars and available carbohydrate

Total sugars were analysed at INMU by HPLC, using evaporated light scattering detector (ELSD). Total sugars include glucose, fructose, lactose, maltose and sucrose.

Data on total sugars are available in selected food items, mainly for food products of most food groups, except Group H (Eggs and their products) and K. (Fat, oils and their products). Few data are presented in processed/products of Group F, G and N. Each set of data in these food products was derived from the average of duplicate analysis of a single composite sample which was prepared from 12 single samples.

For group E (Fruits and their products), total sugars are available in fresh, processed and products. It was noticed that the level of available carbohydrate (calculated by difference) in fruit paste is markedly higher than the level of total sugars of the same foods (34 – 127%). This is more likely due to the addition of other ingredients to the products during processing. Same phenomena but at lower degree was found in candied and dried fruits (13 – 45%) which might be due to sugar alcohol and organic acids which are not included in the determination of total sugars.

Similar phenomena as above were observed in food products of other food groups, e.g., processed milk, thick sauces, bouillon cube, coconut milk. The added ingredients in these products, e.g., starch, thickeners, binders, filler, could overestimate the amount of total available carbohydrate which was calculated by difference. Thus, the analysis of available carbohydrates which includes the free sugars plus dextrans, starch and glycogen is recommended by INFOODS.

Sum of proximate composition

The sum of proximate composition usually falls within the range of 97 - 103 g per 100 g of edible portion. A margin of plus or minus 3% (INFOODS preferred range) is considered acceptable⁽⁷⁾, particularly when many components are determined independently using different samples in different laboratories. However, a wider acceptable range of 95 - 105 g was set by INFOODS⁽⁵⁾. In 2015 Thai FCTs, if the value of carbohydrate (by difference) showed a minus value within the range of 3 g per 100 g, the value is presented as '0_p' (presumed zero). Outside this range, all contributing values and formulae were checked; if the value of carbohydrate showed a minus value of more than 5 g, the value was not included. Two samples of sunchoke with skin, fresh and boiled showed the amount of available carbohydrate (by difference) of -5 and -8 g per 100 g edible portion. They were not included in the FCTs. Future improvement of the data set for the particular food items is required as these forms of sunchoke are commonly consumed.

All conversion factors that contribute to the values of all nutrients (i.e., energy, protein, carbohydrate, total vitamin A as retinol activity equivalent – RAE) and correction factors for fatty acids must be carefully checked, applied and recorded, especially when compiling FCD from different sources.

7. Source code

Source code indicates the origin of the analytical data including in the FCTs. The source code of each data set is presented in the last column of the food index in **Appendix 1**. Sources of data are provided in **Appendix 2**. For commercially processed foods, most of the food composition data were derived from INMU analytical data (1994 - 2014), which were developed for nutritional labelling.

8. Other information related to the use of the FCTs

Recommended amounts of foods to be consumed daily for good health, developed as Food Based Dietary Guidelines (FBDG)⁽³⁷⁾ by the Institute of Nutrition, Mahidol University and the Ministry of Public Health, are provided in **Appendix 4**. For processed foods, reference amounts customarily consumed for various products were developed by the Thai Food and Drug Administration (Thai FDA)⁽³⁵⁾, Ministry of Public Health. They are listed in **Appendix 5**. In addition, the Thai Recommended Daily Intake (Thai RDI)⁽³⁵⁾ for the nutrients which are available in the food composition tables is provided in **Appendix 6**. With the provided information, the actual amount of nutrients per serving, and the amount of nutrients per serving estimated as %Thai RDI, can be calculated. It should be noted that the information in Appendix 4, 5 and 6 is currently being revised; the new information should be announced in 2016. All changes could be followed up from the Information to the FCD Users in the Thai food composition database online at INMU website: <http://www.inmu.mahidol.ac.th/>

9. Additional notes

Thai FCTs 2015 was systematically prepared in accordance with FAO/INFOODS Guidelines. It includes FCD of about 1700 food items. About 30 % of the presented data is directly transferred from the Thai FCTs 1999 (analysed data during 1977 to 1999), about 30 % are combined data from previous and new analysed FCD of the same foods at INMU and from published data which have been systematically evaluated before combination. FCD of new foods obtained mainly from new analysed foods, published papers, and MSc theses at INMU during 1997 to 2014, contributes about 40.% of the total.

Although many omissions have been filled in with new analytical data, some incomplete FCD of some foods are still present. This is mainly because the foods are uncommon or they are not good sources of the missing nutrients or there is a lack of representative or good quality data. In the future, food items and nutrients to be analysed will be identified and prioritised based on the target groups of consumers and/or nutritional problems. The food items with missing data will also be considered.

Ideally, all users require good quality food composition data in terms of representativeness, high analytical quality, comprehensiveness for foods and nutrients, and food description. The analytical data included in the Thai FCTs 2015 are compiled FCD from various sources. Unpublished papers or reports or analytical data from other laboratories, which contributed as minor sources of the FCD may not provide all of the information needed. About 70% of the FCD in FCTs 2015 are analysed data developed at the Institute of Nutrition, Mahidol University. Systematic processes for sampling, sample preparation, nutrients analysis, laboratory control systems, and calculations have been practiced, controlled and documented. In addition, most of the nutrient analyses have been done in laboratories accredited by ISO 17025. These activities increase the quality of the FCD in the Thai FCTs 2015. In addition, the FCD presented the values of each nutrient as mean, SD and the number of combined data sets (N) for the nutrient. The values of SD and N may be used as indicators of the quality of the data and for planning future activity in improving FCD quality.

10. Feedback from the users

The FCDB in the 2015 Thai FCTs will be available in the INMU website, <http://www.inmu.mahidol.ac.th/> by the end of 2015. FCD and information in the website will be periodically updated or corrected. Users are recommended to visit the website which has a system to receive inputs, comments and recommendation from the users which could assist in improvement of the FCD.

Users who require more data or information on nutrients or food items which are not included in these FCTs or related matter are requested to contact at the following address:

Institute of Nutrition, Mahidol University at Salaya
Putthamonthon 4, Salaya, Nakhon Pathom 73170, THAILAND
Tel: +66-2-441 0217; +66-2-800 2380, ext. 423, 324

E-mail: prapasri.puw@mahidol.ac.th;
kunchit.jud@mahidol.ac.th