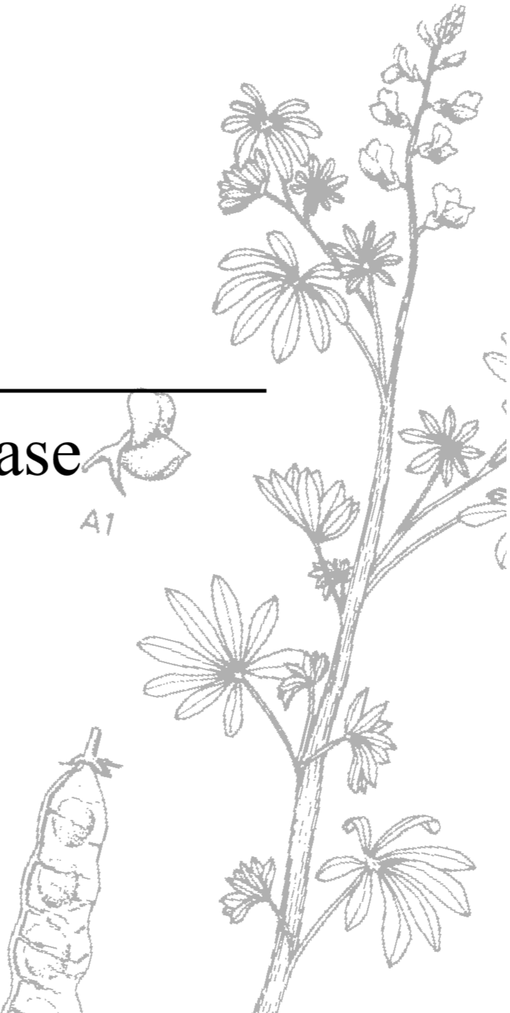
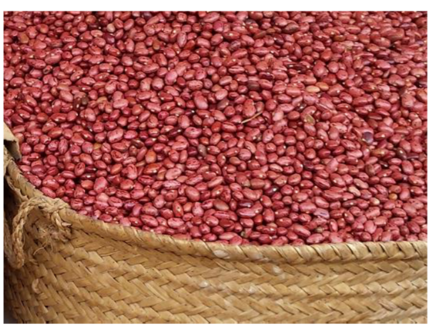
Food and Agriculture Organization of the United Nations



FAO/INFOODS Databases

FAO/INFOODS Global database for pulses on dry matter basis. Version 1.0 - PulsesDM1.0

User guide



2016 INTERNATIONAL YEAR OF PULSES

FAO/INFOODS Global database for pulses on dry matter basis.
Version 1.0 - PulsesDM1.0

User guide

Food and Agriculture Organization of the United Nations
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Prepared by: Fernanda Grande, Barbara Stadlmayr, Morgane Fialon, Sergio Dahdouh, Doris Rittenschober, T Longvah & U. Ruth Charrondiere.

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Contents

Tables

Foreword

Pulses have recently gained more attention. In 2013, the United Nations General Assembly declared 2016 as the International Year of Pulses (IYP) recognizing the importance of pulses for nutrition, health and agriculture. The Food and Agriculture Organization of the United Nations (FAO) was nominated to facilitate the implementation of the IYP in collaboration with Governments, relevant organizations and stakeholders. The IYP aims to increase the awareness on the multiple benefits of pulses for humans and agriculture and thus increase pulse consumption and production.

Most countries face some form of malnutrition, ranging from undernutrition and micronutrient deficiencies to obesity and diet-related diseases (e.g. type II diabetes and certain types of cancer). Diet is an important contributor to both health and disease. Pulses are important food crops and should be part of a healthy diet because they are high in protein, fibre, vitamins, minerals and bioactive compounds while being low in fat.

Even though pulses were part of many traditional diets, pulse consumption has decreased globally often being replaced by animal products. While this might be a positive trend in countries with a low consumption of animal-based foods it can intensify some malnutrition and health problems in developed countries where animal-based foods are already highly consumed. Pulses however remain an important part of the diets of vegetarians in all countries. In some developed countries, the increased awareness of the environmental and health impact of diets has led to a revival of the interest for pulses. Therefore, raising awareness of the contribution of pulses to food security and nutrition can help countries to improve human health.

Food composition data for pulses are needed not only to estimate their contribution to nutrient intakes and diet formulations, but also provide background information on the content of pulses that can be taken into consideration to develop, food-based dietary guidelines or food labelling information. Furthermore, accurate information on the nutrient content of locally available foods are needed for the formulation of complementary foods, development of school meals and for nutrition information.

In many national or regional food composition tables or databases (FCT/FCDB) pulses are poorly covered and in the international scientific literature reliable compositional data on vitamins and minerals contents of pulses are lacking. A comprehensive database on the composition of pulses was therefore considered important by the International Steering Committee of the IYP. FAO was given the tasks to develop a food composition database for pulses.

This first edition of the FAO/INFOODS User Database for Pulses (uPulses) as well as the FAO/INFOODS Database for Pulses on Dry Matter Basis (PulsesDM) are legacies of the IYP. The databases provide high quality data on the nutrient composition of pulses from a wide variety of species (16 pulse varieties). The uPulses can be used to disseminate nutritional information about pulses to promote its production and consumption and hopefully boost policies and programmes on research and breeding of pulses. On the other hand, PulsesDM can facilitate the comparison among the components for different species of raw and cooked pulses on a dry matter basis and be thus useful for standard settings. Their effectiveness would be enhanced if new analytical data on micronutrient content would be generated and included in the databases.

Anna Lartey
Director, Nutrition and Food Systems Division
FAO, Rome

Preface

The International Year of Pulses (IYP) was implemented throughout 2016 and was indeed a very successful year with many activities and media attention worldwide. The main objective of the IYP is to raise awareness of the contribution of pulses to food security, nutrition and health, while contributing to the sustainable management of soils. Pulses have been staple foods for many civilizations for centuries and still are an integral part of the culinary culture. In some parts of the world pulses have a stigma of being a ‘poor person’s food’ and are replaced by meat once people can afford it. Despite all the traditions and actual scientific knowledge, consumers often are unaware of their nutritional and health benefits, therefore greatly undervalue them and do not integrate them into their meal plans. It is well established that pulses are important food crops and offer significant nutritional and health advantages due to their high protein and essential amino acid content as well as being a source of complex carbohydrates, fibre, vitamins and minerals. Additionally, they are environmental-friendly foods as they have a low carbon and water footprint.

Most of the key messages of the IYP are founded on the knowledge of their nutritional composition:

- Pulses are highly nutritious
- Pulses are economically accessible and contribute to food security at all levels
- Pulses have important health benefits
- Pulses foster sustainable agriculture and contribute to climate change mitigation and adaptation
- Pulses promote biodiversity

In order to promote pulses, accurate data on their composition are of the essence. Therefore, the International Steering Committee decided in 2015, before the Year was officially launched, to develop a food composition database on pulses. The FAO/INFOODS User Database for Pulses (uPulses), in which data are expressed per 100 g edible portion on fresh weight basis, as well as the FAO/INFOODS Database for Pulses on Dry Matter Basis (PulsesDM) will remain as important legacies of the IYP and will be the basis to continue promoting pulses for nutrition, food security and agriculture.

Marcela Villarreal
Director, Office for Partnerships, Advocacy and Capacity Development
FAO, Rome

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Abbreviations

Abbreviation	Description
AA	amino acid
av.	average
a	analytical
Ar	analytical and from reference data set
aRF	apparent nutrient retention factor
c.	calculated
DP	decimal place
DM	dry matter basis
EP	edible portion on fresh weight basis
EPDM	edible portion on dry matter basis
e	estimated
FA	fatty acid
FAO	Food and Agriculture Organization of the United Nations
FCDB	food composition database
FCT	food composition table
FW	fresh weight basis
g	gram
INFOODS	International Network of Food Data Systems
IP	inositol phosphate
IP6	inositol hexaphosphate
mg	milligram
N	nitrogen
nd	not detected
r	from reference data set
PA	phytic acid
RF	nutrient retention factor
sig.	significant
tr	trace
uPulses	FAO/INFOODS Global Food Composition Database for Pulses
µg	microgram
YF	weight yield factor
XFA	fatty acid conversion factor
z	estimated zero

1. INTRODUCTION

Background

Pulses are part of the legume family, and are defined as annual leguminous crops yielding between 1 and 12 grains or seeds of variable size, shape and color within a pod, used for both food and feed. The term “pulses” is limited to crops harvested solely for dry grain, thereby excluding crops harvested green for food, which are classified as vegetable crops, as well as those crops used mainly for oil extraction and leguminous crops that are used exclusively for sowing purposes.

Data regarding the nutrient composition of pulses are scarce in food composition tables and databases (FCT/FCDB). Even though many national FCT/FCDB in different countries cover pulses to a certain extend (FAO, 2016) analytical data on the nutrient composition of pulses are lacking in the published international literature for vitamins, minerals and amino acids. In addition, often the food description is very generic, and the coverage of foods emphasizes on major consumed species, while neglecting the minor species. All these factors contribute to limitations of data use as well as imprecisions of nutrient intake estimations through pulses consumption.

The FAO/INFOODS Global Database for Pulses on Dry Matter Basis Version 1.0 (PulsesDM1.0) was developed with the aim to provide a complete nutrient profile for different species based on average values presented in the FAO/INFOODS Global Food Composition Database for Pulses version 1.0, also called uPulses (FAO, 2017).

In 2015, FAO/INFOODS started an extensive literature research on the nutrient composition of pulses. The data search was performed in the Scopus database using common and scientific names for each pulse species associated with some key words.

Data from this literature search were evaluated, compiled and standardized. All compiled data were included in two FAO/INFOODS databases: the FAO/INFOODS Food Composition Database for Biodiversity (FAO, to be published in 2017) and the FAO/INFOODS Analytical Food Composition Database (FAO, to be published in 2017). Both databases represent a repository of solely analytical data found in the published and unpublished literature. These data were the basis for uPulses, being complemented with further analytical datasets obtained through the INFOODS listserv as well as compiled national food composition tables and databases. This step was necessary as most data from the scientific literature reported limited data on vitamins.

The objectives of uPulses suggest the development of a database with representative compositional data on a global, regional, or national level. It needs, however, to be recognized that uPulses can only represent available data of a certain quality, rather than “truly representative” compositional states of the foods presented – especially when considering that data availability per species varied significantly for the different factors affecting the nutrient composition (see *8.* QUALITY CONSIDERATIONS). Due to the lack of data, uPulses cannot represent the existing biodiversity of pulses. Out of the 23 pulse species investigated, only 16 species could be included in uPulses due to the lack of analytical and/or secondary data. Further generation and compilation of analytical data on pulses is therefore necessary to provide a complete picture on the composition of pulses, not only at the species but also at the variety level.

All principles and limitations of uPulses also apply to the FAO/INFOODS Database for Pulses on Dry Matter Basis (PulsesDM) Version 1.0.

Objectives

Food composition databases/tables usually present the content for each component per 100 g edible portion on fresh weight basis (EP). This is mode of expression represents the foods as they can be bought or consumed. As such they can directly be used for e.g. dietary assessment purposes or by consumers.

There are however also other uses for food composition data e.g. for standard setting purposes or in scientific articles where the objective is to compare data without the influence of water content in the food. For these purposes the FAO/INFOODS Database for Pulses on Dry Matter Basis (PulsesDM) was developed to present the components for each food entry on dry matter basis, i.e. all foods are set at zero moisture which equals to a data expression per 100 g of edible portion on dry matter basis (EPDM). Therefore, the aim of PulsesDM is to facilitate the comparison among the components for different species of raw and cooked pulses without the influence of the changing water content.

Thus, the PulsesDM can be used for standard setting or for water-independent comparisons but is unsuitable for a direct use for nutrient intake estimations. For these case the use of the FAO/INFOODS Global Food Composition Database for Pulses (uPulses), which presents components per 100 g edible portion on fresh weight basis (EP) is recommended.

It is important to note that all components values (except for water) are higher in the PulsesDM database than in uPulses as in the latter values are expressed for foods as consumed (EP) while in PulsesDM the water has been removed (EPDM), thus resulting in an artificial concentration of the components. Some users consider dried pulses as equal to dry matter basis. However, it is important to highlight that this is incorrect as dried pulses contain water and can be expressed as per 100 g EP as presented in uPulses.

Outputs and work flow

This User Guide provides an explanation of the foods and component definitions included in PulsesDM as well as the data compilation methodology. The output of PulsesDM include one dataset per 100 g **edible portion on dry matter basis** (EPDM) with data for 61 components. All values were calculated based on average values presented in FAO/INFOODS Global Food Composition Database for Pulses version 1.0 (FAO, 2017).

The Excel file holding the actual compositional data is available at the INFOODS website http://www.fao.org/infoods/infoods/tables-and-databases/faoinfoods-databases/en/.

In a first step, uPulses was finalized. As a second step, PulsesDM was developed by transforming all average values originally expressed per 100 g edible portion on fresh weight basis (EP) into per 100 g edible portion dry matter basis (EPDM). Because of this procedure no additional statistics are presented in PulsesDM such as minimum, maximum, median, standard derivation, or number of data points. The value documentation was however kept representing the source of the original values as in uPulses. It is understood that all values were calculated based on the values presented in uPulses.

2. SELECTION OF SPECIES

Pulses were selected for the data collection according to the FAO classification (1994), however only those with sufficient data of sound quality were included in PulsesDM. The list of vernacular and scientific names for the 16 species of pulses included in PulsesDM version 1.0 is presented both in the Table A1.1. (ANNEX 1) of this guide and in the worksheet '02 List of species' in the Excel file.

3. FOOD ENTRIES INCLUDED

The PulsesDM database contains a total of 16 species of pulses, for which at least one food entry is presented. In total, PulsesDM holds 177 food entries: 61 food entries for raw pulses and 116 food entries for cooked pulses.

Food Item ID
This code is unique for each food and consists of three letters and three digits followed by the letters DM.
For example, PHV001_DM:

- The three letters refer to the code used to identify the pulse species (e.g. PHV stands for *Phaseolus vulgaris*).
- The latter three digits give a serial number within the pulse species.
- The DM indicates that the data is presented on dry matter basis

Food names
The most recognizable and descriptive food name was chosen for the referenced food, with the English name, a detailed description of its edible portion (whole/split), and its state (raw/cooked). Wherever possible, the name further includes information on origin and varieties.

4. COMPONENTS

Definition and expression of nutrients

In the main datasheets in the Excel file, all component values are given per 100 g edible portion on dry matter basis (EPDM). One additional datasheet includes data in table format for amino acids expressed per g nitrogen.

The values reported are mean values derived from several food records with the same/similar food description that have been entered in the archival datasheet (unpublished). The average value for each component was calculated on fresh weight basis for the uPulses elaboration and then converted to dry matter basis (DM) for the PulsesDM. Nutrient values were presented in the following datasheets (see also 9. STRUCTURE OF PulsesDM):

Main datasheets	
04 NV_sum (per 100 g EPDM)	Compositional data for proximates, minerals, vitamins, amino acids, fatty acids classes and phytate expressed per 100 g edible portion on dry matter basis (EPDM) basis, **without** value documentation per component.
05 NV_doc (per 100 g EPDM)	Presents compiled nutrient values per 100 g edible portion on dry matter basis (EPDM) **with** documentation per component.
Additional datasheet	
06 tbl_AA (per g N)	Compositional data for amino acids expressed per g nitrogen, with statistics and value documentation per component.

Note that values per component are presented with significant digits and decimal places as outlined by Greenfield & Southgate (2003).

Table A2.1. and Table A2.2. (ANNEX 2) list the components with their INFOODS component identifiers, units, denominators and number of significant digits.

Proximates and related compounds/ factors

Energy

The metabolizable energy values of all foods are presented in both kilojoules (kJ) and kilocalories (kcal). These are calculated based on protein, fat, available carbohydrates, fibre and alcohol by applying the energy conversion factors as given in Table 1. For pulses alcohol was assumed zero for all entries since fermented foods are not presented in the first version of PulsesDM.

Table 1. Metabolizable energy conversion factors. General Atwater factors (FAO, 2003)

Component	kJ/g	Kcal/g
Protein	17	4
Fat	37	9
Available carbohydrates	17	4
Dietary fibre	8	2
Alcohol[1]	29	7

[1] The alcohol content for all foods in the datasheets is assumed zero.

Equation 1. *Energy (kJ/100 g EPDM) = total protein (g/100 g EPDM) x 17 + total fat (g/100 g EPDM) x 37 + available carbohydrates (g/100 g EPDM) x 17 + dietary fibre (g/100 g EPDM) x 8 + alcohol (g/100 g EPDM) x 29*

Equation 2. *Energy (kcal/100 g EPDM) = total protein (g/100 g EPDM) x 4 + total fat (g/100 g EPDM) x 9 + available carbohydrates (g/100 g EPDM) x 4 + dietary fibre (g/100 g EPDM) x 2 + alcohol (g/100 g EPDM) x 7*

Water

Water is measured as the loss of weight after drying the food sample to constant weight. Values may derive from different drying methods used. All water values were set to zero (0) as data presented in PulsesDM are expressed per 100 g edible portion on dry matter basis (EPDM).

Nitrogen, total and protein, total

The main analytical method used to determine total nitrogen is the Kjeldahl method. The protein content is then estimated from the total amount of nitrogen in the food sample. For most foods including pulses the nitrogen content of protein by weight is 16 %, thus the following equation is applied:

Equation 3. *Total protein (g/100 g EPDM) = total nitrogen (g/100 g EPDM) x 6.25*

In PulsesDM, total protein values originally published were reconverted applying 6.25 to nitrogen values[1].

Pulses also contain non-protein nitrogen. However, no further investigations on the proportion of non-protein nitrogen in the various species presented was carried out and could therefore not be taken into account. This may lead to an overestimation of the total protein value.

Fat, crude

The fat value refers to total lipid including triglycerides, phospholipids, sterols and related compounds. Almost all available data for fat in pulses was analyzed using the classic method based on continuous extraction (e.g. Soxhlet method). Therefore, values presented in the datasheets where mainly determined by continuous extractions even though it may result in incomplete lipid extractions underestimating the fat content. Data referring to preferred analytical methods using mixed solvent extraction or Capillary Gas Chromatography were included in the mean values whenever available and an asterisk (*) is added in the value documentation. Values referring to unknown method were also marked with an asterisk when included in the calculations.

Carbohydrates, available

In PulsesDM, the content of available carbohydrates is estimated by:

Equation 4: *Available carbohydrates by difference (g/100 g EPDM) = 100 - total fat (g/100 g EPDM) - total protein (g/100 g EPDM) - total dietary fibre (g/100 g EPDM) - ash (g/100 g EPDM).*

Fibre, total dietary

The content of dietary fibre was analyzed by the AOAC Prosky method. This is a mixture of non- starch polysaccharides, lignin, resistant starch and resistant oligosaccharides. No data using the most recent official method (AOAC 2011.25) was found in the literature and therefore could not be compiled.

Ash

The ash content of foods is determined by gravimetric methods.

Minerals

The following minerals are included in the datasheets: calcium, copper, iron, magnesium, phosphorus, potassium, sodium and zinc. Several determination methods were reported by the sources, including atomic absorption spectrometry (AAS), inductively coupled plasma (ICP), ICP-mass spectrometry, and colorimetric methods.

[1] Values assigned the tagname <PROT-, total protein with method of determination unknown or variable> are included to calculate values for total nitrogen, assuming that Kjeldahl or similar methods were originally applied to determine total nitrogen.

Fat-soluble vitamins

Vitamin A

Vitamin A is comprised of multiple active compounds, each of them with different biological activity. Retinol is the most bioactive form and is normally only present in animal source foods therefore it is assumed as zero for all the food entries in PulsesDM. In the datasheets, vitamin A is presented both as Retinol Equivalent (RE) and Retinol Activity Equivalent (RAE), calculated according to the following equations:

> ***Equation 5.*** *Total vitamin A activity expressed as Retinol Equivalent (RE) (mcg/100 g* EPDM*) = mcg retinol + 1/6 mcg β- carotene + 1/12 mcg α-carotene + 1/12 mcg β-cryptoxanthin*

> ***Equation 6.*** *Total vitamin A activity expressed as Retinol Activity Equivalent (RAE) (mcg/100 g EPDM) = mcg retinol + 1/12 mcg β- carotene + 1/24 mcg α-carotene + 1/24 mcg β-cryptoxanthin*

Vitamin E

Vitamin E occurs in several active forms such α-tocopherol, β-tocopherol, γ-tocopherol, and δ-tocopherol, and tocotrienols. Only α-Tocopherol values are given in the datasheets. The less active forms were not taken into consideration because few data for pulses were reported. Values referring to unknown method or expression are indicated as such by an asterisk (*) in the value documentation.

Water-soluble vitamins

Thiamin

Values are expressed as thiamin only.

Riboflavin

Sources reported microbiological, fluorimetry and HPLC methods for the determination of riboflavin.

Niacin

The values for niacin are for preformed niacin only (NIA).

Niacin equivalents

Niacin equivalents include the niacin contributed by tryptophan (a niacin precursor) and refer to the potential niacin value; that is the sum of preformed niacin and the amount which could be derived from tryptophan. The mean value of 60 mg tryptophan is considered equivalent to 1 mg niacin (U.S. Department of Agriculture, 2015), i.e.:

> ***Equation 7.*** *Niacin equivalents (mg/100 g* EPDM*) = niacin (mg/100 g* EPDM*) + tryptophan (mg/100 g* EPDM*) / 60*

Vitamin B_6

Vitamin B_6 consists of pyridoxine, pyridoxal and pyridoxamine and their phosphates. Values given in the datasheets were determined by HPLC, while values derived by other methods such as the microbiological assay or unknown method are indicated by an asterisk (*) in the value documentation.

Folate, total

The values refer to total folate determined by microbiological assay in which bound folate is released by enzymatic treatment. Values referring to unknown method, other analytical methods (e.g. HPLC) or expressions are indicated by an asterisk (*) in the value documentation.

Vitamin B_{12}

Vitamin B_{12} is found intrinsically in foods of animal origin therefore it is assumed as zero for all the food entries.

Vitamin C

Values for vitamin C include both L-ascorbic acid and L-dehydroascorbic acid. Where both values were available, they are presented in the datasheets. Where only ascorbic acid data was available, the values are marked by an asterisk (*) in the value documentation.

Fat-related compounds

Cholesterol

The content of cholesterol is assumed as zero for all the food entries since it is not present in plant foods.

Total fatty acids

Total fat consists of triglycerides, phospholipids and unsaponifiable matter. In order to estimate the amount of total fatty acids in the lipid, a fatty acid conversion factor (XFA) is applied:

Equation 8. *Total fatty acids (g/100 g EPDM) = total fat (g/100 g EPDM) x XFA (g/g)*

The XFA used in PulsesDM is equal to 0.775 (U.S. Department of Agriculture, 1988)

Fatty acids classes

Fatty acids (FA) classes for saturated, monounsaturated and polyunsaturated fatty acids are given per food, presented per 100 g EPDM. Table A2.1. (ANNEX 2) lists the fatty acids classes reported with their INFOODS component identifier, units and denominators.

For PulsesDM, all collected fatty acid data reported differently than as *g/100 g total fatty acids* (in this document also referred to as fatty acid profile) were converted to this expression. All fatty acid profiles were evaluated and aggregated, resulting in a mean value for each fatty acid fraction per food entry. Generally, values of individual fatty acids were available from fewer sources than total lipid values.

The mean value for each fatty acid class per 100g EPDM was calculated with data expressed as g/100 g total FA. This method allowed a better evaluation of data on a common basis and explains why value documentation per class are indicated as *calculated (c)* in the documentation.

Amino acids

The amino acid (AA) content is given for 18 amino acids for each food, presented both per 100 g edible portion on dry matter basis (EPDM) and per g nitrogen. Table A2.2. (ANNEX 2) lists the amino acids with their INFOODS component identifier, units and denominators.

Usually amino acids are extracted in three groups—tryptophan, sulfur-containing amino acids (methionine and cystine) and all others. Tryptophan is determined by alkaline hydrolysis/HPLC, methionine and cystine by performic oxidation/HPLC and all others by acid hydrolysis/HPLC.

For PulsesDM, all collected amino acid data were converted to mg/g nitrogen (also referred to as amino acid profile in this document) as a common expression; these data were evaluated and aggregated, resulting in mean amino acid profiles for each food. The amino acid profiles and the total nitrogen content were then used to express the levels of individual amino acids per 100 g EPDM, applying the following formula:

Equation 9. Amino acid (mg/100 g EPDM) = amino acid (mg/g total nitrogen) x total nitrogen (g/100 g EPDM)

This method of compilation allowed a better comparison of the amino acid data on a common basis and explains the reason that value documentation per component is provided for the amino acids profiles per g nitrogen, while those expressed per 100 g EPDM are indicated as *calculated (c)* in the documentation.

In the case of missing amino acid data for a specific food entry, a more generic AA profile per mg/g nitrogen was used to complete these data gaps. The AA data was always borrowed from within the same species.

Phytate

Phytate or inositol phosphates (IP), are saturated cyclic acids found in many plant tissues being most abundant in pulses and cereals. They are considered the main storage form of phosphorus in plants (Mullaney et al, 2007; Frank, 2013). Phytate presents an antinutritional effect in the human diet since the phosphate groups in phytates can bind mineral cations especially iron, zinc or calcium, but also potassium, magnesium and manganese thus lowering their bioavailability (Thavarajah, 2014). The capacity to bind cations was found to be a function of the number of phosphate groups on the myo-inositol ring. Inositol hexaphosphate (IP6), also considered as phytic acid (PA), is the most abundant inositol phosphate. The complex formed by IP6 with minerals is stronger than the ones with IP5 and IP4 (Michaelsen et al, 2009), thus IP6 is has the highest binding capacity.

Different procedures to analyse phytate are available and as each analytical method results in a significantly different value, new tagnames were required in order to classify the different values in function of the detection method. The previous tagname PHYTAC was considered obsolete and new tagnames (Table 2) were created according to the analytical method used.

Table 2. New tagnames, description and units used for phytate in PulsesDM

Tagname	Description	Unit
PHYTCPPI	Phytate, determined by indirect preciptation	mg
PHYTCPPD	Phytate, determined by direct preciptation	mg
PHYTCPP	Phytate, calculated from phytate phosphorus by anion exchange method	mg
PHYTC-	Phytate, calculated from phytate phosphorus by an unknown method	mg
IP3	Inositol triphosphate	mg
IP4	Inositol tetraphosphate	mg
IP5	Inositol pentaphosphate	mg
IP6	Inositol hexaphosphate	mg

The content for each IP fraction analysed by HPLC was presented in PulsesDM when data was available. For some foods entries where it was not possible to give the IP fractions, phytate data determined by other methods were considered and are indicated by an asterisk (*) in the value documentation with the corresponding tagname given under comments. In these cases, preferred tagnames were PHYTCPP or PHYTCPPD. Values for PHYTCPPI were used only when no other data was available.

5. FOOD AGGREGATION AND PRINCIPLES OF IMPUTATION

Generally, foods records with the same description were aggregated in uPulses, following a 'top-down' approach. As PulsesDM is based in uPulses, the same principles for aggregation and imputation apply also to PulsesDM. This means that in the first instance a generic food was compiled, while further distinct foods were created if data availability was sufficient, considering the following characteristics:

- Variety
- Origin (country of production)
- Edible portion (whole or split)

Example of 'top-down' aggregation, *Phaseolus vulgaris* (common beans):

Level 1 Common bean (all types), seeds, mature, whole, dried, raw
Level 2 Black turtle bean, seeds, mature, whole, dried, raw
Level 2 Kidney bean (all types), seeds, mature, whole, dried, raw
Level 3 Black turtle bean, seeds, mature, whole, dried, raw (Canada)
Level 3 Kidney bean, Red, seeds, mature, whole, dried, raw

Considerations:

- Where appropriate, missing values in the nutrient set of a specific food were estimated from a higher level of aggregation.
- Aggregation of distinct food records is principally based on all compositional data; however, data for vitamins and amino acids were often estimated from the generic food due to limited data availability. Furthermore, distinct food records may have a very similar/the same content of nutrient values due to underlying data used for the aggregation.
- Analytical data from scientific articles and reports was always used in preference to compiled data from food composition tables.
- No weighting factors considering global production or market share data were applied when compiling nutrient values for a food.
- No weighting factors were applied considering the inclusion of reference datasets compared to articles from scientific literature or analytical reports. This was mainly done because information on number of samples was often lacking.

6. COOKED FOODS

Nutrient values of cooked pulses were calculated on fresh weight basis using yield factors and nutrient retention factors as published by FAO/INFOODS (2013). As PulsesDM is based in uPulses, the same principles for cooked foods apply also to PulsesDM. Two different cooking procedures were applied wherever possible: (1) boiled without salt, drained (seeds); (2) pulse, boiled without salt (total dish). Except for pea and lentil that do not require soaking prior to cooking, all the pulses were considered as water-soaked drained and soaking water discarded and then boiled in fresh water. All values were then transformed from fresh weight into dry matter basis.

Weight yields factors (YF)
These factors describe the weight change in foods or mixed dishes on fresh weight basis due to losses and gains of water and/or fat during cooking. In uPulses, wherever possible, species-specific yield

factors were used. In PulsesDM, no weight yield factors needed to be applied because data are expressed on DM basis.

Nutrient retention factors (RF)

These factors express the nutrient content retained in the food during preparation or processing. They are defined as the coefficient expressing the preservation of nutrients in a food or dish after storage, preparation, processing, warm holding or reheating. For boiled pulses the RF were applied to minerals, vitamins and inositol hexaphosphate (IP6). The application of retention factors to micronutrients only explain that macronutrient values are the same between raw and cooked foods while values change for micronutrients.

There are no RF available for phytate, therefore two apparent retention factors (aRF) where calculated based on data compiled from literature that analyzed the same samples of pulses raw and cooked. Even though the true RF is the most recommended one it was not feasible to obtain data on the fresh weights of foods before and after cooking. The aRF were calculated according to the following equation:

Equation 10. Apparent retention factor (aRF) = [IP6 content per 100 g of cooked food (dry basis)]/ [IP6 content per 100 g of raw food (dry basis)]

Table 3 gives the RF applied for boiled pulses, based on Bognár (2002), according to the cooking procedure used.

Table 3. Nutrient retention factors applied in PulsesDM

Component	Boiled without soaking		Water-soaked and boiled	
	seeds	total dish	seeds	total dish
Calcium	0.85	1.00	0.85	1.00
Iron	0.85	1.00	0.85	1.00
Magnesium	0.85	1.00	0.85	1.00
Phosphorus	0.90	1.00	0.90	1.00
Potassium	0.75	1.00	0.75	0.90
Sodium	0.75	1.00	0.75	0.90
Zinc	0.90	1.00	0.90	1.00
Copper	0.70	1.00	0.70	1.00
Carotenoids	1.00	1.00	1.00	1.00
α-tocopherol	0.90	1.00	0.90	1.00
Thiamin	0.65	0.80	0.65	0.75
Riboflavin	0.75	1.00	0.75	1.00
Niacin	0.65	0.80	0.65	0.75
Vitamin B6	0.70	0.80	0.70	0.70
Folate	0.50	0.60	0.50	0.55
Vitamin C	0.60	0.60	0.60	0.60
Inositol hexaphosphate (IP6)*	0.67	0.74	0.67	0.74

*Apparent retention factors calculated based on compiled data

Note that the water used to boil the pulses was not included as an ingredient in the calculation. Therefore, for locations where the water presents a high content of some minerals, the recalculation of the mineral content for boiled pulses may be necessary.

7. VALUE DOCUMENTATION

Documentation at food level

For each food in the PulsesDM database, the corresponding food code in the uPulses database is provided in the field 'BiblioID' together with the list of codes corresponding to the underlying data sources. For example, for VIA001_DM 'Adzuki bean, mature, whole, dried, raw' is based on the values of 'Adzuki bean, mature, whole, dried, raw' (VIA001) in uPulses and the data sources is identified in the field 'BiblioID' as VIA001: pu075, pu255, McW/2015 (13-041), USDA/SR28 (16001).

Documentation at component level

For each value the type of acquisition is given to indicate quickly whether a value is 'truly' analytical or refers to a compiled, calculated or estimated value. The abbreviations used for component level documentation are listed in Table 4.

Table 4. Abbreviations and symbols used in PulsesDM

Acquisition type of source	Abbreviation used	Comment
Article from scientific literature Analytical report	*a*	Analytical value
Reference dataset	*r*	Value taken from data compilation, i.e. food composition datasets/databases
Mix of data sources	*ar*	Value represents a mix of data from the scientific literature or reports (i.e. analytical data) or from reference data sets
Calculated	*c*	Value derived by calculation in present dataset (e.g. PROTCNT, ENERGY, see ANNEX 2)
Estimated	*e*	Value borrowed from similar/same food (values may be adjusted/unadjusted), or estimated from calculations.
	z	Value is assumed zero.
	tr	Value is estimated trace.
	*	Tag for values for which INFOODS tagnames referring to a less preferred/inappropriate analytical method were also included in the aggregation, or were the only option available. In the latter case the respective tagname is added in the documentation field.
	Blank	Missing value, i.e. no validated value can be reported. Wherever possible, the content has been estimated from a similar food or calculated based on various analytical data. A zero value cannot automatically be assigned.
	[ ]	Data are considered of lower quality.

Considerations:

- Values labelled with r or ar include data from reference datasets. Users may want to verify the origin of a value by referring to the original material in detail.
- Data from non-preferred tagnames or inappropriate methods were included where preferred tagname data was limited or not available. In these cases, data from non-preferred tagnames or less appropriate methods were included only if they were consistent with values of available, preferred tagnames. Thus, values labelled with an asterisk (*) do not indicate lower quality of values, but allow a precise documentation.

8. QUALITY CONSIDERATIONS

The values in PulsesDM are the result of a comprehensive literature search, additional analytical data and other reference datasets. As PulsesDM is based in uPulses, the same principles for quality considerations apply also to PulsesDM. Because the underlying analytical data used to compile uPulses are mainly results of specific research questions but have not been sampled to represent a global, regional or national average, the presented data have to be taken with caution. To the author's knowledge, however, the data represent the bulk of publicly available data on these pulse species with the set standard for data quality.

Even though great efforts were undertaken to collect and compile data accounting for different origins, data coverage was nevertheless limited. It is therefore recognized that the limited number of data points per species do not permit to present nutrient compositional data that are globally representative.

In some cases the data availability was poor, which resulted in a significant amount of imputed or borrowed data, especially for vitamins. Data were mainly borrowed from national FCT/FCDB and marked accordingly in the documentation.

The final selection of values published is dependent on the judgment of the compilers and their interpretation of available data.

Component variability
For uPulses, component values have been scrutinized and selected carefully for inclusion; however, it is important that users appreciate that the composition of different samples of the same or similar foods may vary considerably. Values can differ as much within a species as between species. Variability in minerals for example can be due to several natural variations in the soil where the pulse was cultivated. Even for macronutrients, such as dietary fibre, a wide range may be found within a species.

The uPulses database, and consequently PulsesDM, has been designed to reflect various factors influencing the composition of pulses by having as many food entries as possible. However, data availability did not always allow a more specific food description.

The main difference between uPulses and PulsesDM is the absence of statistical information in PulsesDM, such as median, minimum, maximum, SD, number of data points and additional comments. If this information would be of interest for the user of PulsesDM, the authors would suggest to obtain this information from uPulses. The recalculation of all values to dry matter basis would have been too cumbersome.

Data remarks
Calculated mean values should not be considered as 'absolute and exhaustive' they derive from various sources and are subject to differences caused by sampling procedures and analytical performance, they also reflect data availability, data quality and estimations made.

Moisture content
A wide range of moisture values for raw pulses was observed in the data collected from scientific articles. To avoid the misinterpretation of the average values calculated for uPulses, only the data with a moisture content between 6.70 - 15% were included. This range was defined based on all the reference datasets presented in the uPulses. Values below 6.70% of moisture may refer to the residual moisture present on the dried samples as analyzed and not the real moisture content of the pulses available for consumption. In some cases, where the only values available for certain compounds were from pulses with moisture outside the acceptable range, the data was converted to dry basis for the calculations and then adjusted to average moisture. For references that presented the results for

different samples using a standardized moisture value, only one data point was taken into account to calculate the average moisture content.

It should be noted that no additional value has been added to PulsesDM which are not included in uPulses, such as data from the literature on dry matter basis.

Data checks
Data were checked prior to publication as per the criteria outlined in FAO/INFOODS (2012a).

9. STRUCTURE OF PulsesDM

The actual compositional data of PulsesDM1.0 and additional information on foods and components can be accessed through the INFOODS website at www.fao.org/fileadmin/templates/food_composition/documents/PulsesDM1.0.xlsx. The structure of PulsesDM is outlined in Table 5; it consists of 9 separate datasheets, where sheets 04 to 06 hold the actual nutrient values.

Table 5. Datasheets in PulsesDM1.0 per 100 g edible portion on dry matter basis (EPDM)

Datasheet title	Description
01 Introduction	Gives an introduction to the tables, incl. information on copyright and disclaimer.
02 List of Species	Presents an overview of the pulse species for which compiled nutrient values are given in PulsesDM and their respective food item IDs used in the actual datasheets (sheets 04-06).
03 Components PulsesDM	Gives an overview of all components that are covered by the uPulses datasheets (sheets 04-05), listing INFOODS tagnames, descriptions, recommended units, max. decimal places and significant digits used.
04 NV_sum (per 100 g EPDM)	Presents compiled nutrient values per 100 g EPDM for raw, processed and cooked foods - without information on statistics and documentation per component.
05 NV_doc (per 100 g EPDM)	Presents compiled nutrient values per 100 g EPDM with documentation per component.
06 AA (per g N)	Presents compiled amino acid values per g nitrogen for raw, processed and cooked foods - includes information on statistics and documentation per AA.
07 Retention Factors	Lists retention factors applied according to the preparation method.
08 Bibliography	Presents the entire reference list with the corresponding ID.

10. CONCLUSION AND RECOMMENDATIONS FOR FUTURE WORK

This is the first edition of the PulsesDM database based on a first review of the available data on the species included in uPulses. This work is the result of a comprehensive data collection, of thorough and demanding investigations on methodological issues concerning phytate analysis and data aggregation.

Even though huge amounts of data were collected, data availability was a major constraint in the development of PulsesDM, especially considering the objectives and principles described earlier (see *1. Introduction*). For example, it was in not possible to separate food entries according to additional factors such as agricultural practices or season and few were presented according to variety and location. It can be concluded that for proximates (i.e. water, fat, protein, and ash) sufficient data but of various quality were available for most species; mineral data were available to a medium extent, although reliable data on phytate were missing; amino acid data do not seem to vary hugely within species which allowed data to be imputed among different food entries within each species; there were very few analytical vitamin data in the international literature and in many cases they needed to be estimated from reference datasets.

It was decided to report the pulses data from different national FCT/FCDB to show the variation in the composition of the species they included. This might be helpful for those looking for species and types of processing or cooking which are not covered by the uPulses database.

The quality of the PulsesDM database could be enhanced by replacing borrowed and estimated values with analytical data in the future. This will only be possible if additional funds will be identified in order to analyse more pulse species in raw and processed forms, and also of those considered minor species. Importantly, more analysis of the vitamin contents need to be carried out in order to fill this large data gap, except for those which are known to be in trace amounts in pulses. Vitamin D is traditionally assumed to be zero in pulses. In this version of uPulses vitamin D_2 was not included as very few analytical vitamin D_2 data were available, suggesting that more investigations are needed for this compound. FAO would appreciate receiving analytical data from different stakeholders, especially on vitamins, in order to include more pulse species, varieties and forms of pulse products as well as higher data quality in future editions of PulsesDM.

This first edition holds the nutrient content of pulses in raw and cooked forms, i.e. cooked without any additional ingredients. It is recommended that future editions include compositional data on different varieties and forms consumed (e.g. sprouts, roasted seeds), more on processed pulses (e.g. flour meal), as well as pulses dishes.

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ANNEX 1. List of species presented in PulsesDM1.0

Table A1.1. list the vernacular names used in PulsesDM with their corresponding scientific names. The scientific name in bold is the legitimate name and all the others were considered as synonyms according to the updated taxonomic database Tropicos (Tropicos, 2016).

Table A1.1. Vernacular and scientific names for the 16 species of pulses included in the PulsesDM

Vernacular name[a]	Scientific name[b]
Common bean (main varieties: Black turtle bean, Kidney bean, Navy bean, Cranberry bean)	***Phaseolus vulgaris* L.** *Phaseolus aborigineus* Burkart *Phaseolus aborigineus* var. hondurensis Burkart *Phaseolus communis* Pritz. *Phaseolus esculentus* Salisb.
Lima bean	***Phaseolus lunatus* L.** *Phaseolus bipunctatus* Jacq. *Phaseolus falcatus* Benth. ex Hemsl. *Phaseolus inamoenus* L. *Phaseolus limensis* Macfad. *Phaseolus macrocarpus* Moench *Phaseolus portoricensis* Bertero ex Spreng. *Phaseolus puberulus* Kunth *Phaseolus rosei* Piper *Phaseolus saccharatus* Macfad. *Phaseolus viridis* Piper *Phaseolus xuaresii* Zuccagni *Phaseolus xuarezii* Zuccagni
Mungo bean	***Vigna mungo* (L.) Hepper** *Azukia mungo* (L.) Masam. *Phaseolus mungo* L. *Phaseolus roxburghii* Wight & Arn.
Adzuki bean	***Vigna angularis* (Willd.) Ohwi & H. Ohashi** *Azukia angularis* (Willd.) Ohwi *Dolichos angularis* Willd. *Phaseolus angularis* (Willd.) W. Wight *Phaseolus nipponensis* Ohwi *Vigna angularis* var. nipponensis (Ohwi) Ohwi & H. Ohashi
Mung bean	***Vigna radiata* (L.) R. Wilczek** *Azukia radiata* (L.) Ohwi *Phaseolus abyssinicus* Savi *Phaseolus aureus* Roxb. *Phaseolus aureus* Wall. *Phaseolus aureus* Zuccagni *Phaseolus hirtus* Retz. *Phaseolus hirtus* Wall. *Phaseolus radiatus* L. *Rudua aurea* (Roxb.) Maekawa

Vernacular name[a]	**Scientific name[b]**
Rice bean	***Vigna umbellata*** **(Thunb.) Ohwi & H. Ohashi** *Azukia umbellata (Thunb.) Ohwi* *Dolichos umbellatus Thunb.* *Dolichos unguiculatus Thunb.* *Phaseolus calcaratus Roxb.* *Phaseolus chrysanthos Savi* *Phaseolus pubescens Blume* *Vigna calcarata (Roxb.) Kurz*
Moth bean	***Vigna aconitifolia*** **(Jacq.) Maréchal** *Dolichos dissectus Lam.* *Phaseolus aconitifolius Jacq.* *Phaseolus palmatus Forssk.* *Vigna aconitifolia (Jacq.) Verdc.*
Cowpea	***Vigna unguiculata*** **(L.) Walp.** *Dolichos biflorus* L. *Dolichos catjang* L. *Dolichos monachalis* Brot. *Dolichos sesquipedalis* L. *Dolichos sinensis* Forssk. *Dolichos sinensis* L. *Dolichos sphaerospermus* (L.) DC. *Dolichos unguiculatus* L. *Dolichos unguiculatus* Thunb. *Vigna catjang* (L.) Walp. *Vigna cylindrica* (L.) Skeels *Vigna sesquipedalis* (L.) Fruwirth *Vigna sinensis* (L.) Endl. ex Hassk. *Vigna sinensis* (L.) Savi ex Hassk.
Bambara groundnut	***Vigna subterranea*** **(L.) Verdc.** *Glycine subterranea* L.
Hyacinth bean	***Lablab purpureus*** **(L.) Sweet** *Dolichos albus* Lour. *Dolichos bengalensis* Jacq. *Dolichos lablab* L. *Dolichos purpureus* L. *Lablab lablab* (L.) Lyons *Lablab niger* Medik. *Lablab vulgaris* Savi *Lablab vulgaris* var. albiflorus DC. *Vigna aristata* Piper
Pea	***Pisum sativum*** **L.** *Pisum vulgare Judz.*
Chickpea	***Cicer arietinum*** **L.** *Ononis crotalarioides Coss.* *Ononis crotalarioides M.E. Jones*

Vernacular name[a]	**Scientific name[b]**
Broad bean	***Vicia faba* L.** *Faba bona Medik.* *Faba faba (L.) House* *Faba major Desf.* *Faba minor Roxb.* *Faba sativa Bernh.* *Faba vulgaris Moench* *Orobus faba Brot.* *Vicia equina Steud.* *Vicia esculenta Salisb.* *Vicia vulgaris Gray* *Vicia vulgaris Uspensky*
Lentil	***Lens culinaris* Medik.** *Ervum lens* L. *Ervum lens* Wall. *Lens esculenta* Moench *Lens lens* (L.) Huth *Vicia lens* (L.) Coss. & Germ. *Vicia pisicarpa* H. Lév.
Lupines	***Lupinus* spp.** Several lupines species
Pigeon pea	***Cajanus cajan* (L.) Huth** *Cajan cajan* (L.) Huth *Cajan inodorum* Medik. *Cajanum thora* Raf. *Cajanus bicolor* DC. *Cajanus cajan* (L.) Merr. *Cajanus cajan* (L.) Millsp. *Cajanus cajan* fo. bicolor (DC.) Baker *Cajanus cajan* var. bicolor (DC.) Purseglove *Cajanus cajan* var. flavus (DC.) Purseglove *Cajanus flavus* DC. *Cajanus indicus* Spreng. *Cajanus indicus* var. bicolor (DC.) Kuntze *Cajanus indicus* var. flavus (DC.) Kuntze *Cajanus indicus* var. maculatus Kuntze *Cajanus luteus* Bello *Cajanus obcordifolia* Singh *Cajanus pseudocajan* (Jacq.) Schinz & Guillaumin *Cajanus striatus* Bojer *Cytisus cajan* L. *Cytisus guineensis* Schumach. & Thonn. *Cytisus pseudocajan* Jacq.

Source: Tropicos.org. Missouri Botanical Garden. 09 Sep 2016 <http://www.tropicos.org>
[a]All species listed are considered to be pulses, but some of them are regarded as vegetables when harvested unripe.
[b]Scientific name in bold is the legitimate name, all the others were considered as synonyms

ANNEX 2. List of components presented in PulsesDM1.0

The tables below list the components used in PulsesDM1.0 with their corresponding INFOODS component identifier (tagname), units and denominators. Table A2.1. gives all components other than fat fractions and amino acids; they are presented in Table A2.2.

Table A2.1. List of components with corresponding INFOODS tagnames, units, denominators and decimal places

Component	INFOODS tagname	Unit	Denominator	Sig. digits	Data-sheet	Comment
Energy	ENERC	kJ, kcal	/100 g EPDM	3	04/05	Calc. from energy-yielding components FAT, CHOAVLDF, PROTCNT, FIBTG (*Equations 1 & 2*)
Water	WATER	g	/100 g EPDM	3	04/05	All water values were set to zero (0) as all data in the datasheets 04/05 are expressed per 100 g EPDM
Dry matter	DM	g	/100 g EPDM	3	04/05	All dry matter values were set to 100 as all data are expressed per 100 g EPDM
Nitrogen, total	NT	g	/100 g EPDM	3	04/05	
Protein, total	PROTCNT	g	/100 g EPDM	3	04/05	Calc. from NT using nitrogen-to-protein factor 6.25 (*Equation 3*)
Fat, total	FATCE	g	/100 g EPDM	3	04/05	Derived by analysis using continuous extraction
Fatty acids, total	FACID	g	/100 g EPDM	3	04/05	Calc. from FAT using the conversion factor for fatty acids (*Equation 8*)
Fatty acids, total saturated	FASAT	g	/100 g EPDM	3	04/05	Calc. from FASAT g/ 100 g FACID
Fatty acids, total monounsaturated	FAMS	g	/100 g EPDM	3	04/05	Calc. from FAMS g/ 100 g FACID
Fatty acids, total polyunsaturated	FAPU	g	/100 g EPDM	3	04/05	Calc. from FAPU g/ 100 g FACID
Cholesterol	CHOLE	mg	/100 g EPDM	3	04/05	
Carbohydrate available, by difference	CHOAVLDF	g	/100 g EPDM	3	04/05	Calc. from proximates WATER, FAT, PROTCNT, ASH, FIBTG (*Equation 4*)
Fibre, total dietary	FIBTG	g	/100 g EPDM	3	04/05	
Ash	ASH	g	/100 g EPDM	3	04/05	
Calcium	CA	mg	/100 g EPDM	3	04/05	
Copper	CU	mg	/100 g EPDM	3	04/05	
Iron	FE	mg	/100 g EPDM	3	04/05	
Potassium	K	mg	/100 g EPDM	3	04/05	
Magnesium	MG	mg	/100 g EPDM	3	04/05	

Component	INFOODS tagname	Unit	Denominator	Sig. digits	Data-sheet	Comment
Manganese	MN	mg	/100 g EPDM	3	04/05	
Sodium	NA	mg	/100 g EPDM	3	04/05	
Phosphorus	P	mg	/100 g EPDM	3	04/05	
Zinc	ZN	mg	/100 g EPDM	3	04/05	
Thiamin	THIA	mg	/100 g EPDM	2	04/05	
Riboflavin	RIBF	mg	/100 g EPDM	2	04/05	
Niacin	NIA	mg	/100 g EPDM	2	04/05	
Niacin equivalents	NIAQ	mg	/100 g EPDM	2	04/05	Calc. of NIA and NIATRP (*Equation 7*)
Vitamin C	VITC	mg	/100 g EPDM	3	04/05	
Vitamin B6	VITB6C	mg	/100 g EPDM	2	04/05	Not preferred/improper tagnames: VITB6A, microbiological assay; VITB6-, unknown expression or method.
Vitamin B12	VITB12	µg	/100 g EPDM	2	04/05	
Folate	FOL	µg	/100 g EPDM	2	04/05	Not preferred/improper tagnames: FOLSUM, sum of vitamers determined by HPLC; FOL-, method unknown or variable.
Vitamin A (RE)	VITA	µg	/100 g EPDM	3	04/05	(*Equation 5*)
Vitamin A (RAE)	VITA_RAE	µg	/100 g EPDM	3	04/05	(*Equation 6*)
Retinol	RETOL	µg	/100 g EPDM	3	04/05	
Beta-carotene equivalent	CARTBEQ	µg	/100 g EPDM	3	04/05	
Alpha-carotene	CARTA	µg	/100 g EPDM	3	04/05	
Beta-carotene	CARTB	µg	/100 g EPDM	3	04/05	
Beta-cryptoxanthin	CRYPXB	µg	/100 g EPDM	3	04/05	
Alpha-Tocopherol	TOCPHA	mg	/100 g EPDM	2	04/05	
Inositol triphosphate	IP3	mg	/100 g EPDM	3	04/05	
Inositol tetraphosphate	IP4	mg	/100 g EPDM	3	04/05	
Inositol pentaphosphate	IP5	mg	/100 g EPDM	3	04/05	
Inositol hexaphosphate	IP6	mg	/100 g EPDM	3	04/05	Not preferred tagnames: PHYTCPPD, phytic acid, determined by direct preciptation; PHYTCPP, phytic acid, calc. from phytate phosphorus, anion exchange method; PHYTPPI, Phytate, determined by indirect preciptation

Table A2.2. List of amino acids with corresponding INFOODS component identifier, units and denominators

Amino acid	INFOODS tagname	Unit	Denominator	Sig. digits	Data sheet	Comment[1]
Isoleucine	ILE	mg	/100 g EPDM	3	04/05	Calc. from ILE/g N
			/g N	3	06	
Leucine	LEU	mg	/100 g EPDM	3	04/05	Calc. from LEU/g N
			/g N	3	06	
Lysine	LYS	mg	/100 g EPDM	3	04/05	Calc. from LYS/g N
			/g N	3	06	
Methionine	MET	mg	/100 g EPDM	3	04/05	Calc. from MET/g N
			/g N	3	06	
Cystine	CYS	mg	/100 g EPDM	3	04/05	Calc. from CYS/g N
			/g N	3	06	
Phenylalanine	PHE	mg	/100 g EPDM	3	04/05	Calc. from PHE/g N
			/g N	3	06	
Tyrosine	TYR	mg	/100 g EPDM	3	04/05	Calc. from TYR/g N
			/g N	3	06	
Threonine	THR	mg	/100 g EPDM	3	04/05	Calc. from THR/g N
			/g N	3	06	
Tryptophan	TRP	mg	/100 g EPDM	3	04/05	Calc. from TRP/g N
			/g N	3	06	
Valine	VAL	mg	/100 g EPDM	3	04/05	Calc. from VAL/g N
			/g N	3	06	
Arginine	ARG	mg	/100 g EPDM	3	04/05	Calc. from ARG/g N
			/g N	3	06	
Histidine	HIS	mg	/100 g EPDM	3	04/05	Calc. from HIS/g N
			/g N	3	06	
Alanine	ALA	mg	/100 g EPDM	3	04/05	Calc. from ALA/g N
			/g N	3	06	
Aspartic acid	ASP	mg	/100 g EPDM	3	04/05	Calc. from ASP/g N
			/g N	3	06	
Glutamic acid	GLU	mg	/100 g EPDM	3	04/05	Calc. from GLU/g N
			/g N	3	06	
Glycine	GLY	mg	/100 g EPDM	3	04/05	Calc. from GLY/g N
			/g N	3	06	
Proline	PRO	mg	/100 g EPDM	3	04/05	Calc. from PRO/g N
			/g N	3	06	
Serine	SER	mg	/100 g EPDM	3	04/05	Calc. from SER/g N
			/g N	3	06	

I7065EN/1/04.17