Internal report on the harmonisation of dilution factors to be used in the assessment of dietary exposure

European Food Safety Authority (EFSA),

Davide Arcella, Sofia Ioannidou, Rita Sousa

Abstract

The Scientific Panels of EFSA perform risk assessment for a wide variety of chemical substances. One of the crucial steps of this process is the dietary exposure assessment where a number of assumptions can be applied at its various steps. Occurrence data received by EFSA are often expressed in different formats, which leads to the use of dilution factors in order to match the occurrence values reported in dry samples with their respective liquid consumption amounts (or vice versa). In its previous scientific outputs, EFSA assumed several dilution factors on a case by case approach. As a consequence of a lack of guidance or reference, different factors were used for the same food groups in various opinions. Considering exposure assessment as a critical component of risk assessment, the present report discusses and provides recommendations on the most appropriate dilution factors to be considered when matching food consumption and occurrence data. Sources were consulted and reviewed, in parallel with the analysis of recommendations described on labels by manufacturers. Where limited information was available, an adequate factor was derived by balancing the pertinence of the information extracted and its historical use by EFSA in previous scientific outputs. The factors suggested in this document represent a step forward in the harmonisation and standardisation of the methodologies used in EFSA. Harmonising the use of the default dilution factors, instead of a case-by-case approach, will improve the quality and validity of EFSA’s scientific outputs.

© European Food Safety Authority, 2018

**Key words:** dilution factor, conversion factor, exposure assessment, occurrence data, food consumption data

**Correspondence:** data.collection@efsa.europa.eu

**Acknowledgements:** EFSA wishes to thank the following for the support provided to this report: Andrea Altieri, Claudia Maria Cascio, Bruno Dujardin, Petra Gergelova, Zsuzsanna Horvath, Laura Kirwan and Jose Angel Gomez Ruiz.

© European Food Safety Authority, 2018

Reproduction is authorised provided the source is acknowledged.

Summary

The Scientific Panels of EFSA perform risk assessment for a wide variety of chemical substances. One of the crucial steps of this process is the dietary exposure assessment where a number of assumptions can be applied at the various steps.

Food consumption and occurrence data received by EFSA have numerous sources (national authorities, universities, industry, etc.). Occurrence data are often expressed in inconsistent formats, which leads to the use of dilution factors in order to match the occurrence values reported in dry samples with their respective liquid consumption amounts (or vice versa). This represents an important step as changes in the concentrations of chemicals caused by processing; drying or dilution (as well as the relative proportion of an ingredient in the case of a composite food) can be substantial and should be taken into account.

In its previous scientific outputs, EFSA assumed several dilution factors on a case by case approach. As a consequence of a lack of guidance or reference, factors used for the same food groups in different EFSA opinions were inconsistent. EFSA has been moving towards the harmonization and standardization of its procedures and methodologies in an effort to improve the quality and validity of its scientific outputs. Considering exposure assessment as a critical component of risk assessment, the present report discusses and provides recommendations on the most appropriate dilution factors to be considered when matching food consumption and occurrence data.

The conversion from the dry to the respective liquid version (or vice versa) can be highly variable, depending on the type of foods, the brand and personal preferences. A similar variability applies to the conversion between dehydrated vegetables and their respective rehydrated amounts, and the dilution of concentrated liquid commodities. The use of dilution factors is therefore an approximation which introduces a certain degree of uncertainty in the overall assessment.

In order to discuss the appropriateness of each dilution factor an array of sources were considered, particularly those in which relevant information had been systematically aggregated. These sources include the FAO Technical Conversion Factors for Agricultural Commodities, tables of nutrient retention factors and weight yields from different countries and food composition tables or databases. Despite their high scientific value, these references are more than 10 years old. This time period comprises extensive market changes and therefore some of these factors may not be applicable to products on the current market. EFSA therefore consulted the Global New Products Database (GNPD) in parallel, and additional literature searches were conducted where relevant. Finally, in the absence of relevant references, especially for groups referring to composite foods, culinary books and recipe websites were consulted to obtain an idea of the relative proportion of ingredients.

In this report, the FoodEx2 system is used to describe foods. Following a brief discussion about available information, factors were retrieved for the following groups: Milk and dairy products, Coffee beverages, Coffee imitates, Cocoa beverages, Tea beverages, Infant and follow-on formulae, Concentrated or dehydrated fruit/vegetables juices, Stock cubes or granulate (bouillon base), Soups, Savoury sauces, Porridges, Children’s Porridges, Potatoes and Mushrooms.

While for some of the food groups, reliable and consistent information was available from the relevant sources, in a number of cases limited and/or inconsistent information was identified. It is important to acknowledge that the factors recommended in this report can represent a source of uncertainty when used, for example, in the assessment of dietary exposure to chemicals. It is therefore recommended that the standard dilution factors suggested here are used only in the absence of more specific information. When limited information was available; an adequate factor was derived by balancing the pertinence of the information extracted from the remaining sources and its historical use by EFSA in previous scientific outputs.

At the same time, the factors suggested in this document represent a step forward in the harmonisation and standardisation of the methodologies used in EFSA. Harmonising the use of the default dilution factors, instead of a case-by-case approach, will improve the quality and validity of EFSA’s scientific outputs.

**Table of contents**

[Abstract 1](#_Toc496264851)

[Summary 3](#_Toc496264852)

[1.1. Background 5](#_Toc496264853)

[1.2. Evidence 5](#_Toc496264854)

[1.3. Additional information 6](#_Toc496264855)

[2.1. Milk and dairy products 6](#_Toc496264856)

[2.2. Coffee beverages 7](#_Toc496264857)

[2.3. Coffee imitates 9](#_Toc496264858)

[2.4. Cocoa beverages 9](#_Toc496264859)

[2.5. Tea beverages 10](#_Toc496264860)

[2.6. Infant and follow-on formulae 11](#_Toc496264861)

[2.7. Concentrated or dehydrated fruit/vegetables juices 12](#_Toc496264862)

[2.8. Stock cubes or granulate (bouillon base) 13](#_Toc496264863)

[2.9. Soups 13](#_Toc496264864)

[2.10. Savoury sauces 14](#_Toc496264865)

[2.11. Porridges 14](#_Toc496264866)

[2.12. Children’s Porridges 15](#_Toc496264867)

[2.13. Potatoes 15](#_Toc496264868)

[2.14. Mushrooms 16](#_Toc496264869)

[References 18](#_Toc496264870)

[Abbreviations 22](#_Toc496264871)

1. Introduction
   1. Background

The Scientific Panels of EFSA perform risk assessment for a wide variety of chemical substances. One of the crucial steps of this process is the dietary exposure assessment. This exposure assessment is normally intended to estimate the likelihood that the consumer will be exposed to a substance and quantifying that exposure, when it occurs (EFSA, 2011).

A number of assumptions can be applied at the various steps of the dietary exposure assessment. Food consumption and occurrence data received by EFSA have a wide range of sources (national authorities, universities, industry, etc.). Occurrence data is often expressed in inconsistent formats, which leads to the use of dilution factors in order to match the occurrence values reported in dry samples with their respective liquid consumption amounts (or vice versa). This represents an important step as changes in the concentrations of chemicals caused by processing; drying or dilution (as well as the relative proportion of an ingredient in the case of a composite food) can be substantial and should be taken into account.

In its previous scientific outputs, EFSA assumed conversion factors on a case by case approach. In the opinion on Acrylamide (EFSA CONTAM Panel, 2015a) the dilution factors, which were applied for the various preparations of coffee, are described. As a consequence of a lack of guidance or reference, factors used for the same food groups in different EFSA opinions were inconsistent (EFSA CONTAM Panel, 2015b; EFSA NDA Panel, 2015).

EFSA has been moving towards the harmonization and standardization of its procedures and methodologies as an effort to improve the quality and validity of its scientific outputs, in particular when assessing dietary exposure (EFSA, 2011). Considering exposure assessment as a critical component of risk assessment, the present report discusses and provides recommendations on the most appropriate factors to be considered when matching food consumption and occurrence data.

The conversion of the dry to the respective liquid version (or vice versa) can be highly variable, depending on the type of food, brands and consumer habits. The same variability applies to the conversion between dehydrated vegetables and their respective rehydrated amounts and the dilution of concentrated liquid commodities. The use of these standard factors is therefore an approximation, which introduces a certain degree of uncertainty in the overall assessment.

* 1. Evidence

In order to discuss the appropriateness of each factor, several sources were considered.

As a first step, sources where relevant information was systematically aggregated were consulted:

* FAO Technical Conversion Factors for Agricultural Commodities (FAO, 2000). The main objective of this document is supporting the estimates of the total availability of food in each country. It contains technical conversion factors and allows the conversion of the amount of the processed product to its original product, in most cases a primary commodity product.
* Tables of nutrient retention factors and weight yields, like the Swedish (Bergström, 1994), German (Bognár, 2002) and the United States Department of Agriculture tables (USDA, 1992). These tables present weight yield factors according to different cooking methods. These yield factors are either collected by pertinent literature or are the result of self-analytical results from studies of the institutions.
* European country’s food composition tables/databases. These food composition tables often provide information regarding the preparation or dilution of some foods.

Despite the high scientific value of the references cited above, it should be noted that generally these references are more than 10 years old. As this time period comprises extensive market changes, these factors may not be applicable to products on the current market. Additionally, the tables do not universally cover all food products for which a dilution factor is intended for in the present report.

Therefore, the Global New Products Database (GNPD) was consulted in parallel. This is an online database from MINTEL Company, which monitors the introduction of new packaged goods in markets worldwide. It contains information of over two million food and beverage products, in which more than 900,000 are or have been available on the European food market. Mintel is currently covering 20 out of the 28 European Union Member States.

Additional literature searches for each food group were conducted where relevant. Finally, in the absence of relevant references, especially for groups referring to composite foods, culinary books and recipes websites were consulted to obtain an idea of the relative proportion of ingredients.

* 1. Additional information

In this report, the FoodEx2 system is used to describe foods (EFSA, 2015). FoodEx2 is a comprehensive food classification and description system developed by EFSA. This classification system attributes a specific code to each food group and allows further description by the use of facets.

The GNPD screening includes products released in the European Union from July 2015 to August 2017. When the number of products retrieved did not allow for a conclusion on a dilution factor, the time period was extended to products released since 2010. For the majority of the products screened, the dilution factor is estimated by dividing the quantity of the powder/dry product by the quantity of liquids to be added as recommended by the manufacturers. The most frequent dilution ratio is considered. Nonetheless, in the cases in which there is no outstanding dilution ratio, the average is assumed.

Following a brief discussion about the information retrieved from the different references for each food group, the main conclusions/recommendations are presented. The recommended dilution factors are summarized in Table 1.

1. Dilution Factors
   1. Milk and dairy products

**From “Milk powder” to “Milk”**

Milk powder is defined as a milk product that can be obtained from the partial removal of water, which should not exceed 5% of the total content of the product[[1]](#footnote-1).

The factor for obtaining dried milk is described by FAO to be 10% for skimmed milks and between 10 and 20% for full fat milks (corresponding to dilution factors among 10 and 20) (FAO, 2000).

Released marketed products corresponding to the previous 24 months and, after widening the search, to products released since 2010 were screened. Manufacturers' instructions varied slightly. On average, for full fat milks, 7 grams of water should be added for each gram of milk powder (dilution factor of 8), while for semi-skimmed/skimmed milks 10 grams of water should be added for each gram of milk powder (dilution factor of 11).

**From “Evaporated milk” to “Milk”**

The group ‘Evaporated milk’ includes any milk with reduced water content and without added sugar.

A conversion factor of 30-50% (3.33-2.00) from full fat milk to full fat evaporated milk and of 40% (2.5) from skimmed milk to skimmed evaporated milk is described by FAO (FAO, 2000).

The most common reference provided by manufacturers to obtain liquid milk is 1.5 part of water to each part of product (dilution factor: 2.5). Evaporated milk is manufactured not only to be consumed in the liquid milk format but also to be added to coffee, tea or as an ingredient in some recipes (soups, casseroles, sauces, desserts, pies, ice cream), this made the interpretation of the labels more difficult.

**From “Dried Condensed milk” to “Condensed Milk”**

The group ’’Dried condensed milk’’ includes milk with reduced water content and often added sugars as minor ingredients.

FAO described a conversion factor of 20-45% from whole milk to whole condensed milk and of 36% from skimmed milk to skimmed condensed milk (FAO, 2000).

Manufacturers do not usually provide instructions for the reconstitution of condensed milk as milk liquid. Instead, they provide recipes for an endless variety of sweets and cakes. Hence, it is not possible to retrieve a dilution factor from the GNPD database.

**Recommendations:**

* A dilution factor of 10 is recommended for the conversion of skimmed and semi-skimmed milk powders to liquid milk. The GNPD search showed no differences between these two types of milk so the value suggested by FAO should be assumed. On the other hand, the factor for the dilution of whole milk powder to full fat milk should be 8 in agreement with FAO and the GNPD.
* When it is not possible to differentiate between the different types of milk, the dilution factor which is more conservative in that context should be used.
* A factor from evaporated milk to full fat milk of 2.5 is recommended, as suggested by FAO.
* The suggested factor for dry condensed milk to liquid condensed milk is 3, as indicated by FAO.
  1. Coffee beverages

The group ‘’Coffee beverages’’ includes any type of coffee beverage, most often made with ground coffee beans and hot water (and possibly other ingredients). Coffee ground is the product obtained by roasting and grinding coffee beans. Depending on the quantity of water added, different preparations of coffee can be possible.

**From “Coffee ground, roasted” to “Coffee (average strength) beverage”**

In FoodEx2, an average strength coffee beverage corresponds to ideally 45-55 grams of coffee per litre and could be produced by diluting 7 grams of coffee in roughly 125-150 mL of water. A typical “Café Americano” would generally fit this description.

These are also the most prevalent instructions provided by coffee product manufacturers, in which the nominal dosing of coffee usually varies between 6 and 10 grams, with 7 grams being the most frequent recommendation. Considering the quantities of water proposed above, the dilution factor should vary between 19 and 22.

Different factors have been used in previous EFSA scientific opinions: the factors of 20 (EFSA CONTAM Panel, 2015a), 18 (EFSA, 2014; EFSA CONTAM Panel, 2014, 2015b; EFSA NDA Panel, 2015) and 17 (EFSA CONTAM Panel, 2009) were previously used to convert coffee ground to “Café Americano”.

**From “Coffee ground, roasted” to “Coffee drink, cappuccino”**

This group includes coffee beverages prepared with an espresso, hot milk, and steamed milk foam. It could be considered that the same quantity of coffee ground (7 grams) is dissolved with an approximate quantity of liquids (water and milk) used to prepare ‘’Café Americano’’ (between 125 and 150 mL). Consequently, the dilution factor would vary equally.

Previously, EFSA assumed the same dilution factor for these two coffee beverages (EFSA, 2014; EFSA CONTAM Panel, 2014, 2015a).

**From “Coffee ground, roasted” to “Coffee espresso (beverage)”**

In FoodEx2, an expresso coffee can be prepared by mixing 7 grams of ground coffee with 30 to 50 millilitres of water. However, this may vary from country to country. The Italian food composition table refers to the preparation of espresso indicating a powder dose of 6 grams (INRAN, 2000).

In the GNPD, the most frequent recommendation for a nominal dose of coffee is 7 grams. Considering this and depending on the quantity of water to be added, the dilution factor could vary between 5 (7 grams + 30 mL of water) to 8 (7 grams + 50 mL water).

EFSA has previously used dilution factors for coffee espresso within this range: 5 (EFSA CONTAM Panel, 2015a) and 7 (EFSA, 2014; EFSA CONTAM Panel, 2014, 2015b)

**From “Instant coffee powder” to “Instant coffee (beverage)”**

According to the description on the FoodEx2 browser catalogue, instant coffee beverages can usually be prepared by diluting 3.4 grams of powdered instant coffee in roughly 150 mL of water (dilution factor of 45).

The United Kingdom’s composition table (McCance and Widdowson's, 2015) specifies the quantities for both preparations and it differentiates the preparation with water (dilution of 111) and the preparation with milk plus water (dilution factor of 125).

Manufacturer’s recommendations for the reconstitution of instant/soluble coffee are not always provided and the ones that exist are highly heterogeneous. The recommended quantity of powder can vary from 1.5 to 4.0 grams, while the suggested quantities of liquid for reconstitution can vary widely (between 55 to 280 mL). Typically, the products which foresee the powder dilution in a lower quantity of water, are intended to produce an “Instant espresso”, while others are intended to produce an “Instant café Americano”. Regardless of this, the most frequent dilution ratios provided by manufacturers are 50 and 75 (corresponding to the addition of 2 grams to 100-150 mL of water).

The dilution factors of 50 (EFSA CONTAM Panel, 2015a), 60 (EFSA NDA Panel, 2015) and 63 (EFSA, 2014; EFSA CONTAM Panel, 2014, 2015b) were previously used by EFSA for instant coffee powder and are aligned with the results obtained by screening the GNPD database.

**From “Coffee beverage-preparation, powder” to “Coffee drink, cappuccino”**

In FoodEx2, this group includes the powdered mix of coffee extracts and other ingredients (like milk components, sugar or other flavourings) that are intended to prepare a coffee-based hot drink by dilution with hot liquids such as milk or water.

The quantity of dry product to be added usually varies between 10 and 27 grams. Accordingly, the quantity of liquid recommended by manufacturers also varies, from 120 to 250 mL. This mainly depends on the powder composition, in which the proportions of coffee and milk are not always homogeneous.

As no manufacturers’ preparation instructions from the GNPD prevail in relation to the others, the median dilution factor, 11, is therefore considered.

**Other coffee types**

Café macchiato is considered a coffee beverage usually prepared with an espresso and the addition of a small amount of milk. Café macchiato is prepared by dissolving 7 grams of ground coffee in water and an additional small amount of steamed milk, filling up the coffee cup (approximately 60 mL).

Coffee with milk or cream is considered a coffee beverage usually prepared with a coffee beverage (e.g. Café Americano) and the addition of a small amount of milk.

Iced coffee refers to a cold coffee with the possible addition of ice (e.g. shakerato coffee).

There is a lack of information regarding the appropriate dilution factors for these coffees. For this reason, a pragmatic approach can be assumed.

EFSA has previously considered 7 as the most appropriate dilution factor for café macchiato and 18 for both Coffee with milk and Iced Coffee (EFSA CONTAM Panel, 2017)

**Recommendations:**

* Generally, the nominal dose of coffee is considered as being 7 grams by the majority of manufacturers, regardless of the end-product (espresso or café Americano). The more frequent dilution factors previously used by EFSA are in line with the remaining references. Consequently, the dilution factor of 18 should be considered for ‘’Coffee (average strength) beverage’’ i.e. Café Americano and “Coffee drink, cappuccino”.
* From “Coffee ground, roasted” to “Coffee espresso” a factor of 7 is recommended. This is in line with what was assumed by EFSA in previous opinions.
* From “Instant coffee powder” to “Instant coffee (beverage)” a dilution factor of 63 is recommended. This is in line with the median of the most frequent factors extracted from the GNPD and values previously most frequently considered by EFSA (EFSA, 2014; EFSA CONTAM Panel, 2014, 2015b).
* From “Coffee beverage-preparation, powder” to “Coffee drink, cappuccino” a dilution factor of 11 is recommended. This is based on a limited number of products extracted from the GNPD.
* The same amount of coffee powder is used for both espresso and café macchiato and only a small quantity of foam milk is added. Likewise, the preparation between café Americano and “Coffee with milk” or “Iced Coffee” is not very different. Therefore, the factors of 7 and 18 can be extrapolated as a worst case assumption. These dilution factors were previously considered by EFSA on its assessment on furan (EFSA CONTAM Panel, 2017).
  1. Coffee imitates

**From “Coffee imitate ingredients” to “Coffee imitate beverages”**

The group ‘’Coffee imitates’’ includes any type of coffee imitate and substitute beverage/infusion. In general, products are either instant/soluble or intended to be brewed. The manufacturers’ recommendations for these two types vary.

In the GNPD database, it is not always evident by interpreting the labels if the product is intended to be brewed or if they are instant. In the case of the instant product, the more commonly indicated preparation is the addition of 150 mL of water to 2-3 grams of the coffee imitates (barley, chicory, etc.). This results in a dilution factor of 50. For the brewed coffee imitate the preparation instructions are quite variable, either for the quantity of dry product as for the quantity of liquid to be added.

**Recommendations:**

* From instant coffee imitate powders to instant coffee imitate beverages, a dilution factor of 50 is recommended. This is in agreement with the recommendations found on product labels for instant coffee imitate powders.
* For the brewed coffee imitate powders it was not possible to define specific dilution factors. However, it seems reasonable to assume the same factor as for brewed coffee (a factor of 18), as the preparation process is the same.
* When no information on the processing of the coffee imitates is available, the dilution factor, which is more conservative in the specific context, should be used.
  1. Cocoa beverages

**From “Cocoa powder” to “Cocoa beverage”**

The “Cocoa powder” group includes any powder obtained solely from cacao beans. The “Cocoa beverage’’ group includes any heated beverage made from cocoa powder by dissolving it in hot milk or water.

Manufacturers’ recommendations vary between the addition of an unspecified quantity of water or milk to a quantity of product that can vary between 5 and 15 grams. For these products the most common dilution factor indicated by the producers is 50.

Previously, a conversion factor from “Cocoa powder” to “Hot chocolate” of 0.028 (dilution factor of 36) was used in the EFSA scientific opinion on acrylamide (EFSA CONTAM Panel, 2015a), while a dilution factor of 60 was used in other EFSA opinions (EFSA CONTAM Panel, 2014, 2015b; EFSA NDA Panel, 2015).

**From “Cocoa beverage-preparation, powder” to “Hot chocolate”**

The ’’Cocoa beverage-preparation, powder’’ group includes any type of beverage-preparation powder with cocoa and other ingredients, such as milk components, sugar or flavourings. These are intended to be diluted with hot liquids like milk or water to prepare a cocoa-based hot drink. The group ‘‘Hot chocolate’’ includes heated beverages made from cocoa powder and other ingredients or flavourings, dissolved in hot milk or water.

In the United Kingdom’s food composition table (McCance and Widdowson's, 2015), “Drinking chocolate powder, made up with semi-skimmed milk”, “Drinking chocolate powder, made up with skimmed milk” and “Drinking chocolate powder, made up with whole milk” were considered to be prepared with 18 g of product to 200 mL of milk (dilution factor: 12).

Products extracted from the GNPD, with added sugar and added sugar/milk, have similar preparation instructions than those listed in the United Kingdom’s food composition table. For products containing cocoa powder and added sugar only, the most frequent instruction by manufacturers suggest a dilution factor of 12.5. For products containing cocoa powder, added milk and other ingredients as sugar, the instructions are less variable and the most common dilution factor is 10.

The analysis based on the GNPD allows the distinction between products that are composed of 100% cocoa powder and those which have additional ingredients, such as milk and sugar. In fact, the higher the content on cocoa is the higher the indicated dilution.

Recently, EFSA assumed a dilution factor of 11 for cocoa-beverage preparations (EFSA CEF Panel, 2017). This value was retrieved by analysing food labels and it is in line with the ones retrieved in the current exercise.

**Recommendations:**

* EFSA has previously considered various factors for the dilution of cocoa powder. However, it is not always possible to interpret if these correspond to products with or without the addition of other ingredients, or if they were considered altogether.
* From “Cocoa powder” to “Hot chocolate” a dilution factor of 60 is recommended. This is the most common ratio suggested on 100% cocoa powder products marketed since 2015.
* From “Cocoa beverage-preparation, powder” to “Hot chocolate”, the most frequent ratios are 10 (for powders with added sugar and dried milk, diluted in water) and 12.5 (for powders with added sugar only, diluted in milk). To consider these products together, the lower dilution factor of 10 is recommended.
  1. Tea beverages

**From “Tea leaves, dry and/or fermented and similar” to “Tea beverages”**

The first group, ‘’Tea leaves, dry and/or fermented and similar’’ includes any type of tea leaves, dry and/or fermented (e.g. black tea, earl grey, orange pekoe or breakfast tea) and similar (non-fermented teas as green or white tea) from the Tea plant (*Camellia sinensis*). “Tea beverages’’ is a group including beverages usually made with the addition of water or another liquid to tea leaves derivatives or tea-based ingredients. The composition of a tea beverage is extremely dependent on several factors such as the brewing temperature, time, size and quantity of the tea leaves, among others (Pastoriza et al., 2017).

The United Kingdom’s Food Composition Table (McCance and Widdowson's, 2015) considered the preparation of black tea with 15 g of tea dry leaves to 1 litre of water. Other studies (Ramalho et al., 2013; Nikniaz et al., 2016) from literature used standard quantities for analysing the chemical and/or biological properties of tea, which vary from the ratio of 1 gram/100 mL to 2 grams/240 mL.

The German table on weight yields (Bognár, 2002) proposes the quantity of 1.5 g of dried leaves to each 100 mL of water, not distinguishing whether it is a fermented tea or an herbal/non-tea infusion.

The screening in the GNPD shows that the most frequent weight of black tea and earl grey teabags is 2 grams. The products do not often specify the amount of water that should be used to dissolve the tea leaves.

EFSA has previously considered 100 as an adequate dilution factor, considering the infusion of 2 g of a selected plant/herbal to 200 mL of water (EFSA CONTAM Panel, 2014, 2015b; EFSA NDA Panel, 2015). More recently, the dilution factor of 75 was used assuming the beverages were prepared using 2 grams in 150 mL of water (EFSA, 2016). This factor was assumed as most reliable as the samples used in the exposure estimations came from the Tea & Herbal Infusions Europe (THIE), where the beverages were prepared by using 2 grams in 150 mL of water.

**From “Herbal infusion materials from leaves and herbs” to “Herbal and other non-tea infusions”**

The FoodEx2 group “Herbal infusion materials from leaves and herbs” includes any type of herbal infusion materials obtained from leaves and herbs. By soaking them in water or hot liquids, it is possible to obtain herbal and other non-tea infusions.

The screening process of the GNPD database does not show differences in the size of the teabags, when comparing to tea beverages coming from “Tea leaves and stalks, fermented”. Additionally, EFSA has previously considered the same dilution ratio of 75 for both teas and herbal infusions (EFSA CONTAM Panel, 2014, 2015b; EFSA, 2016).

**From “Tea extract (powder)” to “Tea beverages”**

This group includes any type of tea extract in powder form. There is currently no information available regarding these extracts on the main national composition/yield weights tables.

Equally, not many products are retrieved when searching the GNPD even after widening the time period to include products from 2010 to present. Despite the limitation of products, manufacturers’ recommendations on the labels are quite consistent and usually indicate the addition of 200 mL of water to a quantity of 15-20 grams of instant tea powder which results, generally, in a dilution factor of 11.

**Recommendations:**

* From “Tea leaves and stalks, fermented” to “Tea beverages” and from “Herbal infusion materials from leaves and herbs” to “Herbal and other non-tea infusions” a dilution factor of 75 is recommended. This is in line with the information extracted from the GNPD and the values recently considered by EFSA.
* From “Tea extract (powder)” to “Tea beverages” a dilution factor of 11 is recommended.
  1. Infant and follow-on formulae

This group includes any type of Infant and follow-on formulae as defined by EU legislation[[2]](#footnote-2).

**From “Infant formulae, powder” to “Infant formulae, liquid”**

Infant formulae are manufactured foods that are intended for babies during the first months of life. The screening on all “Baby Formula (0-6 months)” entered into the market in the last 24 months showed that the standard manufacturers' instruction for most products is one scoop of infant formula powder to 30 mL of water. The types/brands of formulae come with scoops which have inconsistent measuring sizes. The most frequent scoop size is 4.5 grams of powder per spoon, but this generally varies between 4.3 to 5.0 grams. Products coming from other types of milk, such as goat milk, typically have scoop sizes within ranging between 4.1 and 4.8 grams. Regarding the scoop size of formulae for “Special Medical Purposes”, this varies between 4.3 and 5.4 grams. A systematic review conducted in the United Kingdom on formula feed preparation demonstrated that scoop sizes can range from 4.0 to 5.0 grams (Renfrew et al., 2003).

It was not possible to retrieve any information from yield weights’ tables or national food composition tables. However, the information retrieved from the GNPD is consistent. The most frequent scoop size of 4.5 grams results in a dilution factor of approximately 8. This dilution factor was previously assumed by EFSA in scientific outputs (EFSA, 2014; EFSA CONTAM Panel, 2014, 2015a, b, 2016; EFSA Scientific Committee, 2017) and is in agreement with literature (Kersting et al., 1998).

**From “Follow-on formulae, powder” to “Follow-on formulae, liquid”**

Follow on formulae, which are also manufactured foods, are consumed by infants as a part of a progressively diversified diet. A screening on all “Baby Formula (6-12 months)” showed a standard recommendation of one scoop of follow-on formula powder to 30 mL of water, which is consistent with the preparation of the ‘’Infant formulae, powder’’. Once more, the scoop sizes vary depending on the brand and type of product. Generally, this varies between 4.1 to 5.0 grams of powder per spoon. “Foods for infants for Special Medical Purposes” and formulae containing goat milk are less frequent and their spoons vary within the same range as the general follow-on formulae.

Similarly, EFSA assumes the same dilution factor for the powdered follow-on formulae as for the infant formulae and a dilution factor of 8 was therefore considered (EFSA, 2014; EFSA CONTAM Panel, 2014, 2015a, b, 2016).

**Recommendations:**

* There are no relevant differences between the scoop sizes of infant and follow-on formulae. Therefore, the same dilution factor can be assumed for both of them.
* From “Infant formulae, powder” to “Infant formulae, liquid” and from “Follow-on formulae, powder” to “Follow-on formulae, liquid” it is recommended to use a dilution factor of 8. This is based on information extracted from the GNPD and on factors previously used by EFSA.
  1. Concentrated or dehydrated fruit/vegetables juices

**From “Fruit juice concentrates” to “Fruit juices”**

The “Fruit juice concentrates’’ group includes any product obtained by reducing the water content of fruit juices. Even though these concentrates are mainly used as a beverage, they can be used as an ingredient in recipes.

Concerning fruit concentrates, a consistent factor of 3 was retrieved from the FAO technical report on conversion factors (FAO, 2000). The information retrieved from the laboratory manual “Procedures for analysis of citrus products” (JBT FoodTech, 2011) confirms this value. The Swedish table of yields recommends a dilution factor of 4 to produce a ready to serve fruit juice from its concentrate (Bergström, 1994).

There is some variability in the instructions for the dilution ratio provided by manufacturers. The dilution quantity can vary between 3 to 15 parts of water to 1 part of concentrate. Although the median dilution ratio is 7, there are a considerable number of products for which dilution factors start at 3. In fact, it is challenging to determine if these products are referring to real fruit juice concentrates or to cordials or squashes.

**From “Dehydrated/powdered fruit juice” to “Fruit juices”**

This group includes any type of dehydrated or powdered fruit juice.

There is limited information regarding these products both in the national food composition tables, yield weights’ tables and in the GNPD.

**Recommendations:**

* The most appropriate dilution factor for fruit juice concentrates is 3, as suggested by FAO.
* The information on dilution factors retrieved from the GNPD is probably referring to cordials and squashes. The median factor of 7 should therefore be considered for these types of juices.
* From “Dehydrated/powdered fruit juice” to “Fruit juices” a dilution factor of 11 is recommended. This value is an extrapolation from the dilution factor for instant tea beverages.
  1. Stock cubes or granulate (bouillon base)

**From “Stock cubes or granulate, meat” to “Meat soup, clear”**

This group includes any type of meat stock cubes or granulate that can be diluted in order to produce a clear meat soup (without meat pieces). In the German table of weight yields (Bognár, 2002), factors of approximately 33 and 50 are described for chicken and beef bouillon, respectively. Information retrieved from the French food composition table (ANSES, 2016) and the Portuguese food composition table (INSA, 2015) are in agreement with these dilution factors proposed by the German table.

Labels of the meat stock cubes products released into the market in the last 24 months show that there are uniform instructions by the manufacturers. These typically correspond to the addition of 1 stock cube to 500 mL of water. The weight for most of the stock cubes varies between 9 and 11 grams. This leads to a dilution factor of approximately 50.

**From “Stock cubes or granulate, vegetables” to “Mixed vegetables soup, clear”**

This group includes any type of vegetable stock cubes or granulate that can produce any type of a clear mixed vegetables soup (without pieces), by dilution. Indications for the use and dilution of vegetable stock cubes are not available in most of the food composition or yield weight’s tables.

Manufacturers’ instructions on marketed vegetable stock cube products reveal less consistent instructions by the manufacturers, which usually correspond to the addition of 1 stock cube to 500 mL of water. The weights for the stock cubes vary in the same range as those of meat, from 9 to 11 grams. The dilution factor is approximately 50.

**Recommendations:**

* EFSA previously used 50 as a suitable dilution factor (EFSA CONTAM Panel, 2010), without any distinction between meat, vegetable or meat and vegetable stock cubes. This is in agreement with the values retrieved from the database of Mintel. The same factor should continue to be considered.
  1. Soups

**From “Soups (dry mixture uncooked)” to “Soups (ready-to-eat)”**

The group ’’Soups (dry mixture uncooked)’’ include any type of soup that is intended to be re-hydrated for consumption. The German table of weight yields proposes factors for the preparation of dry soups that vary between approximately 9 (in the case of a green bean soup) and 17 (in the case of a chicken noodle soup) (Bognár, 2002). However, it is important to note that these recommendations are also based on the instructions displayed in product labels. The McCance table also describes the nutritional composition for a product of prepared dried soup. This soup was prepared with 24 grams of powder made up with 225 mL of water (dilution factor of 10) (McCance and Widdowson's, 2015).

As brands of dry soups come with varying package weights and recommendations for the quantity of water to be added, instructions for the same product can vary widely among different brands extracted from the GNPD. In addition, within the same brand the nature of the ingredients seems to be a determining factor for the dilution. According to the preparation instructions labelled on vegetable cream soup products, the most frequently used dilution ratios range between 9 and 17. Although for dry soups containing meat or meat products this varies between 6 and 20, the most frequent instruction results in a dilution factor of 14. Considering all dry soups together, 10 is the most frequent recommended dilution indicated on labels.

**Recommendations:**

* From “Soups (dry mixture uncooked)” to “Soups (ready-to-eat)” a dilution factor of 10 is recommended. This dilution factor was previously used by EFSA (EFSA, 2016) and is in agreement with the British food composition table and within the range of the German Table. Additionally, this dilution factor is confirmed by the information extracted from the GNPD database.
  1. Savoury sauces

**From “Savoury sauces, STATE=Powder” to “Savoury sauces”**

The ‘’Savoury sauces’’ group in FoodEx2 is very broad and heterogeneous, including mayonnaise and related sauces, alcoholic sauces, tomato based sauces, white sauces, mustard sauces, meat sauces, herbal/vegetable sauces, etc. However, it is not possible to determine appropriate dilution factors for each of the subcategories and a unique dilution factor for all sauces is proposed in this document.

In the different tables of yields, the dilution factors range from approximately 6 (in the case of a tomato sauce) to 13 (in the case of a meat sauce). The GNPD database confirms these values.

The different instructions by manufacturers also demonstrate the heterogeneity of this group. The portion of dry product to be prepared can vary between 9 to 88 grams, while the quantity of water to add varies from 30 to 1000 mL. This obviously results in a wide range of dilution factors that can vary between 4 and 26, with no particular factor standing or being more frequent. The median dilution factor retrieved by analysing the GNPD is 10.

**Recommendations:**

* From “Savoury sauces, STATE=Powder” to “Savoury sauces” it is recommended a dilution factor of 10 is used. This dilution factor was used by EFSA (EFSA ANS Panel, 2017). This factor is in the range of those present in the national tables of yields and it is supported by information extracted from the GNPD.
  1. Porridges

**From “Porridge (in dry form, to be diluted)” to “Porridge (ready to eat)”**

This group includes porridges in their dry form, which are intended to be diluted with milk or water. The ready to eat porridge products are obtained by boiling or by soaking rolled, crushed, or steel cut grains or other cereal meals in water, milk, or both. Often tables of yields report on the losses of water by evaporation while cooking, but do not report on adequate dilution factors.

The search in the GNPD shows that these products are composed not only by cereals but they often present a number of different ingredients. The recommended dilution factor is influenced by the type(s) and actual quantity of the cereal(s) present in the product. However, it is also not possible to conclude on a specific dilution factor for each type of porridge, as there is not enough information and a unique dilution factor for all porridges is proposed in this document. The instructions by manufacturers suggest a quantity between 15 to 160 grams to be dissolved in a volume of liquid that varies between 100 and 1000 mL. The median dilution factor is 7, but there are quite a lot of products with lower dilutions.

Recently, EFSA applied a dilution factor of 5 for the conversion of dry porridges on its prepared form (EFSA, 2017).

**Recommendations:**

* From “Porridge (in dry form, to be diluted)” to “Porridge (ready to eat)” a dilution factor of 7 is recommended. This is based on the values used previously by EFSA, which are aligned with the information extracted from the GNPD.
  1. Children’s Porridges

**From “Simple cereals which have to be reconstituted with milk or other appropriate nutritious liquids” to “Simple cereals for infants or children, reconstituted”**

The following text concerns the appropriate dilution factor for this group, which includes any type of simple cereal which is ready for consumption after the reconstitution with milk or other appropriate nutritious liquids.

The main source of information is the GNPD database. For these products, the instructions provided by the producers indicate a reconstitution factor between 5 and 10. Although the latter is the most frequent, more than half of the products present indications of lower dilutions ratios.

**From “Cereals with an added high protein food which have to be reconstituted with water or other protein-free liquid” to “Cereals with an added high protein food reconstituted”**

These groups include any type of Cereal with an added high protein food that after the addition of liquid (with water or other protein-free liquid) are ready for consumption.

From the GNPD database, it is possible to observe that milk protein is frequently used to enrich these products. The cereals used in these products differ widely on the type and quantity/proportion. As a result, the quantity of cereal and water to be added are identically variable (among 20 and 55 grams and 60 and 200 mL, respectively). The most frequent reconstitution instruction by manufacturers is 1 part of cereals to 4 parts of water.

**Recommendations:**

* From “Simple cereals which have to be reconstituted with milk or other appropriate nutritious liquids” to “Simple cereals for infants or children, reconstituted” a dilution factor of 7 is recommended. This dilution factor was previously used by EFSA (EFSA, 2016; EFSA CONTAM Panel, 2016; EFSA, 2017) and is confirmed by information extracted from the GNPD.
* From “Cereals with an added high protein food which have to be reconstituted with water or other protein-free liquid” to “Cereals with an added high protein food reconstituted” a dilution factor of 4 is recommended. This dilution factor was previously used EFSA (EFSA, 2016; EFSA CONTAM Panel, 2016; EFSA, 2017) and is confirmed by information extracted from the GNPD.
  1. Potatoes

**From “Potato flakes” or “Mashed potato powder” to “Potato puree from flakes or powder”**

The group “Potato flakes’’ includes potato products that have undergone drying and flaking processes. The group ‘’Mashed potato powder’’ refers to other powdered products used to make mashed potato. These products are considered together for the remit of this report.

In the GNPD, the various brands of potato flakes, commonly labelled as *instant puree* or *mashed* *potatoes*, present inconsistent instructions for reconstitution. Many products include ingredients such as cheese, onions, bacon or broccoli. Pack sizes vary between 45 to 180 grams and the volume of water to be added varies between 225 mL to 900 mL, proportionally in most cases. The majority of the instructions refer to a ratio of 1g of potato flakes to 4 mL of water (a dilution factor of 5).

**Recommendations:**

* From “Potato flakes” or “Mashed potato powder” to “Potato puree from flakes or powder” a dilution factor of 5 is recommended. This is based on information extracted from the GNPD.
  1. Mushrooms

**From “Dried mushrooms” to “Fungi”**

The group “Fungi’’ includes any type of fruiting body of fungi used as a source of food. After being subjected to drying processes they result in dried mushrooms, which can later be soaked and/or boiled for rehydration. The yields for the two processes described above are expected to be different, as the water uptake during rehydration will not make up the water loss after drying.

The values found on product labels marketed on the previous 24 months are not clear regarding the rehydration factors. Nonetheless, important information regarding the fresh equivalent amount is available and often corresponds to a factor of 10. EFSA previously assumed a factor of 9 to recalculate the values from dry to fresh product (EFSA, 2009). In the year 2000, FAO suggested 26% as the conversion between fresh and dry mushrooms (conversion factor of approximately 4) (FAO, 2000).

Other authors studied the impact of the drying process method on the characteristics of the mushrooms, such as colour, nutrient retention and rehydration ratio. In the first study, the ratios achieved by the processes varied between approximately between 3 and 4 (Tian et al., 2016). In another study in 2014, the ratio varied approximately between 3 and 5 (Kantrong et al., 2014).

**Recommendations:**

* From “Dried mushrooms” to “Fungi” (fresh) a conversion factor of 10 is recommended. A factor of 4 should be considered for the rehydration process.

1. Recommended conversion and dilution factors

| From | | To | | | Dilution factor |
| --- | --- | --- | --- | --- | --- |
| Milk and dairy products | | | | |  |
| A02PL | Milk powder, skimmed | A02MA | Cow milk, skimmed (low fat) | | 10 |
| A02PJ#F10.A077G | Milk powder, QUAL=Semi-skimmed | A02LZ | Cow milk, semi skimmed (half fat) | | 10 |
| A02PK | Milk powder, full fat | A02LY | Cow milk, whole | | 8 |
| A02PF | Evaporated milk (liquid, unsweetened) | A02LT | Milk, full fat | | 2.5 |
| A02PG | Condensed milk (sometimes with added sugars) | A02PG #F28.A07MR | Condensed milk (sometimes with added sugars), reconstituted | | 3 |
| Coffee beverages | | | | | |
| A03GN | Coffee ground, roasted | A03KC | | Coffee (average strength) beverage | 18 |
| A03GN | Coffee ground, roasted | A03KH | | Coffee drink, cappuccino | 18 |
| A03GN | Coffee ground, roasted | A03KB | | Coffee espresso (beverage) | 7 |
| A03GQ | Instant coffee powder | A03KE | | Instant coffee (beverage) | 63 |
| A0F2E | Coffee beverage-preparation, powder | A03KH | | Coffee drink, cappuccino | 11 |
| A03GN | Coffee ground, roasted | A03KJ | | Coffee drink, café macchiato | 7 |
| A03GN | Coffee ground, roasted | A03KG | | Coffee with milk or cream | 18 |
| A03GN | Coffee ground, roasted | A03KK | | Iced coffee | 18 |
| Coffee imitates | | | | | |
| A03GS | Coffee imitate ingredients | A03KL | | Coffee imitate beverages | 50 / 18 |
| Cocoa beverages | | | | | |
| A03HG | Cocoa powder | A03KY | | Cocoa beverage | 60 |
| A03HH | Cocoa beverage-preparation, powder | A03LA | | Hot chocolate with added ingredients | 10 |
| Tea beverages | | | | | |
| A04KK | Teas leaves, dry and/or fermented, and similar | A03LB | | Tea beverages | 75 |
| A03JK | Herbal infusion materials from leaves and herbs | A03LG | | Herbal and other non-tea infusions | 75 |
| A03HY | Tea extract (powder) | A03LB | | Tea beverages | 11 |
| Infant and follow-on formulae | | | | | |
| A03PZ | Infant formulae, powder | A03QE | | Infant formulae, liquid | 8 |
| A03QK | Follow-on formulae, powder | A03QQ | | Follow-on formulae, liquid | 8 |
| Concentrated or dehydrated fruit/vegetables juices | | | | | |
| A03BN | Fruit juice concentrates | A0BY4 | | Fruit juices | 3 |
| A03GE | Liquid drink bases (including concentrates and home-made preparations) | A0BY4 | | Fruit juices | 7 |
| A03CG | Dehydrated/powdered fruit juice | A0BY4 | | Fruit juices | 12.5 |
| Stock cubes or granulate (bouillon base) | | | | | |
| A0BZ7 | Stock cubes or granulate, meat | A0BZB | | Meat soup, clear | 50 |
| A043J | Stock cubes or granulate, vegetables | A0BZ8 | | Mixed vegetables soup, clear | 50 |
| Soups | | | | | |
| A0B9J | Soups (dry mixture uncooked) | A041L | | Soups (ready-to-eat) | 10 |
| Savoury sauces | | | | | |
| A043V#F03.A06JD | Savoury sauces, STATE=Powder | A043V | | Savoury sauces | 10 |
| Porridge | | | | |  |
| A00EN | Porridge (in dry form, to be diluted) | A0F0V | | Porridge (ready to eat) | 5 |
| Children’s Porridges | | | | | |
| A03QY | Simple cereals which have to be reconstituted with milk or other appropriate nutritious liquids | A0BZE | | Simple cereals for infants or children, reconstituted | 7 |
| A03QZ | Cereals with an added high protein food which have to be reconstituted with water or other protein-free liquid | A0BZF | | Cereals with an added high protein food reconstituted | 4 |
| Potatoes | | | | | |
| A011D | Potato flakes | A0C6J | | Potato puree from flakes or powder | 5 |
| Mushrooms | | | | | |
| A00TY | Dried mushrooms | A0ETG | | Fungi | 10 / 4 |

1. Conclusions

The present document discusses and suggests the use of dilution factors when matching consumption and occurrence data, as these data may be reported in different forms for the same product.

It should be acknowledged that some of the suggested factors are more uncertain than others. While, for some of the food groups, reliable and consistent information was available from the relevant sources, in some cases limited and/or inconsistent information was identified.

Furthermore, any estimation or instruction related to food or recipe preparation is associated with a high number of factors which increase variability. Consumer habits and personal preferences, brand diversity and even small differences between product characteristics (within the same brand) can introduce a certain degree of heterogeneity for the overall assessment. Besides, it is not only the quantities used in the preparation that influence the composition of the final product; taking the example of tea, the temperature of the water used to infuse the herbs, as well as the time of infusion are relevant aspects for the final concentrations of many chemicals in liquid tea or herbal infusions.

Therefore, it is important to acknowledge that the factors recommended in this report can represent a source of uncertainty when used, for example, in the assessment of dietary exposure to chemicals. It is therefore recommended that the standard dilution factors suggested here are used only in the absence of more specific information; the use of a specific dilution factor for a well-defined sauce or fruit juice concentrate, should be preferred to a standard factor.

However, these dilution factors are intended as an approximation and are the result of a parallel critical review of relevant references with the current practices on market by manufacturers. Where information was not available; an adequate factor was derived by balancing the pertinence of the information extracted from the remaining sources and its historical use by EFSA in previous Scientific Outputs.

At the same time, the factors suggested in this document represent a step forward in the harmonisation and standardisation of the methodologies used in EFSA. Harmonising the use of the default dilution factors, instead of a case-by-case approach, will improve the quality and validity of EFSA’s scientific outputs.

References

ANSES (French Agency for Food Environmental and Occupational Health & Safety), 2016. ANSES/Ciqual French food composition table version 2016. Available online: https://pro.anses.fr/tableciqual/

Bergström L (Swedish National Food Administration), 1994. Rapport 32/94: Nutrient Losses and Gains in the preparation of foods. NLG Project 1983-1993:1-223. Available online: http://www.fao.org/uploads/media/Bergstroem\_1994\_32\_Livsmedelsverket\_nutrient\_losses\_and\_gains.pdf

Bognár A (German Federal Research Centre for Nutrition), 2002. Tables on weight yield of food and retention factors of food constituents for the calculation of nutrient composition of cooked foods (dishes) 98 pp. Available online: http://www.fao.org/uploads/media/bognar\_bfe-r-02-03.pdf

EFSA (European Food Safety Authority), 2009. Potential risks for public health due to the presence of nicotine in wild mushrooms. EFSA Journal 2009;7 RN-286, 1-47 . doi:10.2903/j.efsa.2009.286r Available online: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2009.286r/epdf

EFSA (European Food Safety Authority), 2011. Overview of the procedures currently used at EFSA for the assessment of dietary exposure to different chemical substances. EFSA Journal 2011;9(12):2490.,33pp. doi:10.2903/j.efsa.2011.2490 Available online: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2011.2490/epdf

EFSA (European Food Safety Authority), 2014. Dietary exposure to inorganic arsenic in the European population. EFSA Journal 2014;12(3):3597 doi:10.2903/j.efsa.2014.3597 Available online: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2014.3597/epdf

EFSA (European Food Safety Authority), 2015. The food classification and description system FoodEx 2 (revision 2). EFSA supporting publication 2015: EN-804, 90 pp. Available online: http://onlinelibrary.wiley.com/doi/10.2903/sp.efsa.2015.EN-804/pdf

EFSA (European Food Safety Authority), 2016. Dietary exposure assessment to pyrrolizidine alkaloids in the European population. EFSA Journal 2016;14(8):4572, 50 pp. doi:10.2903/j.efsa.2016.4572 Available online: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2016.4572/epdf

EFSA, Arcella D, Eskola M and Gómez Ruiz JA (European Food Safety Authority), 2016. Dietary exposure assessment to Alternaria toxins in the European population. EFSA Journal 2016;14(12):4654, 32 pp. doi:10.2903/j.efsa.2016.4654 Available online: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2016.4654/pdf

EFSA, Arcella D, Gómez Ruiz JÁ, Innocenti ML and Roldán R (European Food Safety Authority), 2017. Scientific report on human and animal dietary exposure to ergot alkaloids. EFSA Journal 2017;15(7):4902, 53 pp. Available online: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2017.4902/pdf

EFSA ANS Panel (EFSA Panel on Food Additives and Nutrient Sources added to Food), Mortensen A, Aguilar F, Crebelli R, Di Domenico A, Dusemund B, Frutos MJ, Galtier P, Gott D, Gundert-Remy U, Lambré  C, Leblanc J-C, Lindtner O, Moldeus P, Mosesso P, Parent-Massin D, Oskarsson A, Stankovic I, Waalkens-Berendsen I, Wright M, Younes M, Tobback P, Horvath Z, Tasiopoulou S and Woutersen RA (EFSA Panel on Food Additives and Nutrient Sources added to Food), 2017. Re-evaluation of oxidised starch (E 1404), monostarch phosphate (E 1410), distarch phosphate (E 1412), phosphated distarch phosphate (E 1413), acetylated distarch phosphate (E 1414), acetylated starch (E 1420), acetylated distarch adipate (E 1422), hydroxypropyl starch (E 1440), hydroxypropyl distarch phosphate (E 1442), starch sodium octenyl succinate (E 1450), acetylated oxidised starch (E 1451) and starch aluminium octenyl succinate (E 1452) as food additives. EFSA Journal 2017;15(10):4911, 96 pp. doi:10.2903/j.efsa.2017.4911 Available online: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2017.4911/epdf

EFSA CEF Panel (EFSA Panel on Food Contact Materials, Enzymes, Flavourings and Processing Aids), Silano V, Bolognesi C, Castle L, Cravedi J-P, Fowler P, Franz R, Grob K, Gürtler R, Husøy T, Kärenlampi S, Mennes W, Milana MR, Penninks A, Smith A, de Fátima Tavares Poças M, Tlustos C, Wölfle D, Zorn H, Zugravu C-A, Chesson A, Glandorf B, Hermann L, Jany K-D, Marcon F, Želježić D, Arcella D, Liu Y, Rygaard Nielsen KR and Engel K-H, 2017. Scientific Opinion on the safety evaluation of the food enzyme β-amylase obtained from barley (Hordeum vulgare). EFSA Journal 2017;15(5):4756, 22 pp. doi: 10.2903/j.efsa.2017.4756 Available online: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2017.4756/epdf

EFSA CONTAM Panel (EFSA Panel on Contaminants in the Food Chain), 2009. Scientific Opinion on Arsenic in Food. EFSA Journal 2009; 7(10):1351. [199 pp.]. doi:10.2903/j.efsa.2009.1351.Available online: http://dx.doi.org/10.2903/j.efsa.2009.1351

EFSA CONTAM Panel (EFSA Panel on Contaminants in the Food Chain), 2010. Scientific Opinion on Lead in Food. EFSA Journal 2010; 8(4):1570. [151 pp.]. doi:10.2903/j.efsa.2010.1570. Available online: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2010.1570/epdf

EFSA CONTAM Panel (EFSA Panel on Contaminants in the Food Chain), 2014. Scientific Opinion on the risks to public health related to the presence of chromium in food and drinking water. EFSA Journal 2014;12(3):3595, 261 pp. doi:10.2903/j.efsa.2014.3595 Available online: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2014.3595/epdf

EFSA CONTAM Panel (EFSA Panel on Contaminants in the Food Chain), 2015. Scientific Opinion on acrylamide in food. EFSA Journal 2015;13(6):4104, 321 pp. doi:10.2903/j.efsa.2015.4104 Available online: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2015.4104/epdf

EFSA CONTAM Panel (EFSA Panel on Contaminants in the Food Chain,), 2015. Scientific Opinion on the risks to public health related to the presence of nickel in food and drinking water. EFSA Journal 2015;13(2):4002, 202 pp. doi:10.2903/j.efsa.2015.4002 Available online: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2015.4002/epdf

EFSA CONTAM Panel (EFSA Panel on Contaminants in the Food Chain), Knutsen HK, Alexander J, Barregård L, Bignami M, Brüschweiler B, Ceccatelli S, Cottrill B, Dinovi M, Edler L, Grasl-Kraupp B, Hogstrand C, Hoogenboom L, Nebbia CS, Oswald IP, Petersen A, Rose M, Roudot A-C, Schwerdtle T, Vleminckx C, Vollmer G, Chipman K, De Meulenaer B, Dinovi M, Mennes W, Schlatter J, Schrenk D, Baert K, Dujardin B and Wallace H, 2017. Scientific Opinion on the risks for public health related to the presence of furan and methylfurans in food. EFSA Journal 2017;15(10):5005, 142 pp. doi: 10.2903/j.efsa.2017.5005 Available online: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2017.5005/epdf

EFSA NDA Panel (EFSA Panel on Dietetic Products, Nutrition and Allergies), 2015. Scientific Opinion on the safety of caffeine. EFSA Journal 2015;13(5):4102, 120 pp. doi:10.2903/j.efsa.2015.4102 Available online: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2015.4102/epdf

EFSA CONTAM Panel (EFSA Panel on Contaminants in the Food Chain), Knutsen HK, Alexander J, Barregård L, Bignami M, Brüschweiler B, Ceccatelli S, Dinovi M, Edler L, Grasl-Kraupp B, Hogstrand C, Hoogenboom L, Nebbia CS, Oswald I, Petersen A, Rose M, Roudot A-C, Schwerdtle T, Vollmer G, Wallace H, Cottrill B, Dogliotti E, Laakso J, Metzler M, Velasco L, Baert K, Ruiz JAG, Varga E, Dörr B, Sousa R and Vleminckx C 2016. Scientific Opinion on erucic acid in feed and food. EFSA Journal 2016;14(11):4593, 173 pp. doi:10.2903/j.efsa.2016.4593 Available online: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2016.4593/epdf

EFSA Scientific Committee, Hardy A, Benford D, Halldorsson T, Jeger MJ, Knutsen HK, More S, Naegeli H, Noteborn H, Ockleford C, Ricci A, Rychen G, Schlatter JR, Silano V, Solecki R, Turck D, Bresson J-L, Dusemund B, Gundert-Remy U, Kersting M, Lambré C, Penninks A, Tritscher A, Waalkens-Berendsen I, Woutersen R, Arcella D, Court Marques D, Dorne J-L, Kass GEN and Mortensen A, 2017. Guidance on the risk assessment of substances present in food intended for infants below 16 weeks of age. EFSA Journal 2017;15(5):4849, 58 pp. doi: 10.2903/j.efsa.2017.4849 Available online: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2017.4849/epdf

FAO (Food and Agriculture Organization of the United Nations), 2000. Technical Conversion Factors for Agricultural Commodities, FAO, Rome. Available online: http://www.fao.org/fileadmin/templates/ess/documents/methodology/tcf.pdf

INRAN (Istituto nazionale di ricerca per gli alimenti e la nutrizione), 2000. Tabelle di composizione degli alimenti. Revisione 2000. Available online: <http://nut.entecra.it/646/‌tabelle_di_composizione_degli_alimenti.html>

INSA (Instituto Nacional de Saúde Doutor Ricardo Jorge), 2015. Portuguese Food Composition Table (TCA) V 2.0. pp. Available online: http://portfir.insa.pt/#

John Bean Technologies FoodTech (JBT FoodTech Citrus Systems), 2011. Procedures for Analysis of Citrus Products Laboratory Manual. Manual No. 054R10020.000-6. Available online: <https://www.coursehero.com/file/24857080/PROCEDIMIENTOS-DE-ANALIZIS-DE>

CITRICOSpdf/Kantrong H, Tansakul A and Mittal GS, 2014. Drying characteristics and quality of shiitake mushroom undergoing microwave-vacuum drying and microwave-vacuum combined with infrared drying. Journal of Food Science and Technology 2014;51(12):3594–3608. doi:10.1007/s13197-012-0888-4 Available online: [https://www.ncbi.nlm.nih.gov/pubmed/‌25477627](https://www.ncbi.nlm.nih.gov/‌pubmed/25477627)

Kersting M, Alexy U, Sichert-Hellert W, Manz F and Schoch G, 1998. Measured consumption of commercial infant food products in German infants: results from the DONALD study. Dortmund Nutritional and Anthropometrical Longitudinally Designed. J Pediatr Gastroenterol Nutr. 1998;27:547–552.

McCance and Widdowson's, 2015. Composition of foods integrated dataset (CoFID). Public Health England, United Kingdom. Available online: <https://www.gov.uk/government/publications/‌composition-of-foods-integrated-dataset-cofidNikniaz>

Nikniaz Z, Mahdavi R, Ghaemmaghami SJ, Lotfi Yagin N and Nikniaz L, 2016. Effect of different brewing times on antioxidant activity and polyphenol content of loosely packed and bagged black teas (Camellia sinensis L.). Avicenna Journal of Phytomedicine. 2016;6(3):313-321. Available online: <https://www.ncbi.nlm.nih.gov/pubmed/27462554>

Pastoriza S, Pérez-Burillo S and Rufián-Henares JÁ, 2017. How brewing parameters affect the healthy profile of tea. Current Opinion in Food Science. 2017;14:7-12. doi: 10.1016/j.cofs.2016.12.001 Available online: <https://www.sciencedirect.com/science/article/pii/S2214799316301795>

Ramalho SA, Nigam N, Oliveira GB, de Oliveira PA, Silva TOM, dos Santos AGP and Narain N, 2013. Effect of infusion time on phenolic compounds and caffeine content in black tea. Food Research International 2013;51(1):155-161. doi:10.1016/j.foodres.2012.11.031 Available online: https:// ‌[www.sciencedirect.com/science/article/pii/S0963996912005005](http://www.sciencedirect.com/science/article/pii/S0963996912005005)

Renfrew MJ, Ansell P and Macleod K, 2003. Formula feed preparation: helping reduce the risks; a systematic review. Archives of Disease in Childhood. 2003;88(10):855-858. doi:10.1136/adc.88.10.855.

Tian Y, Zhao Y, Huang J, Zeng H and Zheng B, 2016. Effects of different drying methods on the product quality and volatile compounds of whole shiitake mushrooms. J. Food Chem. 2016;15;197(Pt A):714-22. doi:10.1016/j.foodchem.2015.11.029

USDA (United States Department of Agriculture), 1992. Weights, Measures, and Conversion Factors for Agricultural Commodities and Their Products. Agricultural Handbook No. (AH-697), USA. 77 pp. Available online: <https://www.ers.usda.gov/webdocs/publications/41880/33132_ah697_002.pdf?v=‌42487>

Abbreviations

|  |  |
| --- | --- |
| EFSA | European Food Safety Authority |
| FAO | Food and Agriculture Organization of the United Nations |
| GNPD | Global New Products Database |
| THIE | Tea & Herbal Infusions Europe |
| USDA | United States Department of Agriculture |

1. Council Directive 2001/114/EC of 20 December 2001 relating to certain partly or wholly dehydrated preserved milk for human consumption. OJ L 15, 17.1.2009, p. 19–23. [↑](#footnote-ref-1)
2. Commission Directive 2006/141/EC of 22 December 2006 on infant formulae and follow-on formulae and amending Directive 1999/21/EC Text with EEA relevance [↑](#footnote-ref-2)