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Process-specific technical data used in exposure assessment of food enzymes

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Abstract

Technical data for exposure assessment of food enzymes Dietary exposure is part of the overall assessment of food enzymes. In order to develop food process-based exposure models, a number of different input data are required in tandem with technical conversion factors. This allows for a combination of use levels with food consumption data, which are typically reported as consumed. The use levels are expressed as total organic solids/kg raw materials. For each food process, EFSA identified a list of food groups and collated technical conversion factors. To ensure uniform application of FoodEx food categories and technical conversion factors in the assessment of food enzyme dossiers, stakeholders were consulted via open calls-for-data. Feedback was analysed. This document reports the consolidated input parameters for each food process. Regular updates have been made on a yearly basis since 2018, as further process-specific parameters were generated. The consolidated input data have been used to calculate dietary exposure during the evaluation of food enzyme applications. As well as publishing the input parameters, process-specific calculators of the food enzyme intake models (FEIM) have also been developed on the basis of summary statistics. These calculators have been deposited at <https://zenodo.org/> for open access.

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1. Introduction

1.1. Background and Terms of Reference as provided by the requestor

1.1.1. Background as provided by EFSA in 2017

“The CEF Panel has resumed the evaluation of several food enzyme dossiers by implementing the strategy and methodology outlined in the “Statement on exposure assessment of food enzymes” published in November 2016. This methodology follows the best practice in the area of regulated dietary assessment. For dossiers that have been received by EFSA, as individual consumption data in the EFSA Comprehensive Consumption Database are only directly accessible in EFSA, dietary exposure to the food enzyme is being calculated in-house at EFSA.

The recently published Food Additive Intake Model (FAIM) has shown that it is feasible to allow third parties utilising the individual consumption data in the EFSA Comprehensive Consumption Database without infringing confidentiality issues.

With the efforts made in defining food-process relevant food groups and in consolidating technical conversion factors necessary to combine the use levels and consumption data, the CEF Panel is in position to develop an intake model that is specific to food enzymes. Such a model will contribute to speeding up the evaluation of the food enzyme dossiers, as well as enable applicants to prepare future food enzyme dossiers.”

1.1.2. Terms of Reference

In accordance with Article 29(1) of Regulation (EC) No 178/2002, the European Food Safety Authority asks its scientific Panel on Food Contact materials, Enzymes, Flavourings and Processing Aids (CEF) to develop a web-based Food Enzyme Intake Model. The deliverables should include:

- Intermediate output 1: an addendum to the already published Panel statement, entitled ‘Annex B - Process-specific recipe and technical conversion factors’.
- Intermediate output 2: a series of Excel-based tools for calculating exposure to food enzymes used in specific processes.
- Final output: a web-based food enzyme intake model (FEIM).

1.2. Interpretation of the Terms of Reference

The intermediate output 1 was issued for the first time in 2018 as ‘Annex B - Process-specific technical data used in exposure assessment of food enzymes’ to the ‘Statement on exposure assessment of food enzymes’ (EFSA CEF Panel, 2016). This was updated in 2019 and 2020, each time adding more food processes. In 2021, the ‘Statement on exposure assessment of food enzymes’ was incorporated into the revised ‘Scientific Guidance for the submission of dossiers on Food Enzymes’ (EFSA CEP Panel, 2021). The intermediate output 2 consists of a series of Excel-based FEIM calculators that are made from technical data reported in the intermediate output 1.

Applicants now are directed to Annex D of the revised Guidance, and requested to align the uses of the food enzyme under application to the food manufacturing processes described therein. The Annex D of the revised guidance does not provide the source or details of technical conversion factors that underpin the existing FEIM calculators or those to be used in the development of further models. As technical conversion factors are still being developed for additional food processes, it is necessary to continue to document and make available the technical details used for the calculation of exposure. This current document is intended to show how the existing process-specific FEIM calculators were developed and, where FEIM models are not yet available, to illustrate to applicants the data set needed to allow EFSA to complete an exposure assessment. As a result, Annex D of the Guidance will need regular updates as additional food processes are considered.

2. Data and methodologies

2.1. Data

Process-specific technical conversion factors are derived from several sources, which includes the EFSA Raw Primary Commodity (RPC) Model, publicly available recipe information, food label information, as well as the FAO technical conversion factors.

2.2. Methodology

For each food process, EFSA compiled a list of FoodEx categories and derived technical conversion factors. This list is then published as call-for-data on the EFSA website to seek feedback from stakeholders. A full list of call-for-data can be retrieved at <https://www.efsa.europa.eu/en/search?s=enzyme+calls>.

3. Development of assessment tools

Food enzymes are used in a variety of food processes to manufacture foods or food ingredients at industrial scale. For the purpose of estimating dietary exposure to food enzymes, food consumption data and food enzyme use levels need to be expressed on the same basis. Typically, food enzyme usage data are expressed on a raw material basis, whereas food consumption data typically refer to food as consumed. Consequently, tools allowing the interconversion of these data sets are needed to facilitate the assessment.

Given the complexity associated with tracing the exposure to food enzymes from physical raw material, across different food manufacturing processes and to foods as consumed, the CEP Panel developed a methodology that takes into account the specific food processes in which food enzymes are used and their fate during food processing (EFSA CEP Panel, 2021). Consequently, each food enzyme application will require assessment of each individual food process for which the food enzyme is intended to be used.

In order to develop food processes-based exposure models, a number of different input data are required in tandem with technical conversion factors to allow for a combination of use levels expressed on raw material with food consumption data, which are typically reported as consumed.

Food consumption data are decoded by FoodEx categories in the EFSA Comprehensive European Food Consumption Database. The assignment of FoodEx categories to a specific food process is guided by the food processes in which food enzymes are intended to be used. In some cases, the selection of food groups to be included is straightforward, e.g. in the case of the processes 'baking' and 'brewing', the selection of relevant food categories focussed on food products having undergone a baking process (e.g. bread, fine bakery ware) or a brewing process (e.g. beer, malt drinks). In other cases, where the final food product produced with the aid of a food enzyme is an ingredient that can be added to a number of foods, details provided by the applicant, searches in the EFSA RPC model¹ and the Mintel Database,² or other relevant sources are used to identify foods which are likely to contain the ingredient. The RPC model does not always capture the level of detail that is required to conduct dietary exposure assessment to food enzymes. Because of this, the Mintel database is consulted.

Technical conversion factors are used to combine the food enzyme use levels and food consumption data. Making use of factors reported in the RPC Model, the FAO technical conversion factors, publicly available recipe information, food label information from the Global New Products Database (GNPD),³ EFSA derived technical conversion factors specific for each food process.

As technical conversion factors and food categories can vary for different reasons, especially those related to recipes that might be influenced by industrial practices, country to country variability, etc., each specific factor is subject to expert judgement, and consequently is associated with a certain level of uncertainty. To ensure uniform application of FoodEx food categories and technical conversion factors in the assessment of food enzyme dossiers, stakeholders were consulted on the selected food categories and technical conversion factors. Feedback from stakeholders was analysed. This document reports the consolidated input parameters for each food process. Regular updates have been made on a yearly basis since 2018, as further process-specific parameters are generated. The consolidated input

¹ The model is accessible at <https://doi.org/10.2903/sp.efsa.2019.EN-1532>

² <https://www.mintel.com/global-new-products-database>

³ The database is accessible at <https://www.mintel.com/global-new-products-database>

data have been used to calculate dietary exposure during the evaluation of food enzyme applications and to develop FEIM models.

The information provided in this document is presented in tables containing the following details:

FoodEx code	EFSA FoodEx classification food category code
FoodEx category	EFSA FoodEx classification food category name – food category relevant to the food process and included in the exposure assessment
Technical conversion factor f1	Conversion factor converting the food or ingredient consumed into the material to which the food enzyme is added
Technical conversion factor f2	Ingredient fraction reflecting the amount of ingredient in the food as consumed in which the food enzyme is present
Technical conversion factor f3	Fraction of the overall food group selected, which is likely to actually contain the food enzyme

Factor f1 is a technical conversion factor applied to food or food ingredient in order to bring it on par with the raw material to which the food enzyme is added. For example, beer is converted to barley grain, to which the food enzyme is added during the brewing process.

Factor f2 represents the ingredient fraction of interest in a food included in the exposure assessment. For example, bread contains 70% flour; therefore, consumption of bread is corrected by a factor of 0.7 to reflect the flour component only.

Factor f3 is only used in those cases when only a certain percentage of food products within a larger food category are likely to contain the food enzyme.

This factor is derived by using the Mintel GNPD database. This database monitors worldwide product launches of packaged foods. It contains information of over 2 million food and beverage products of which more than 800,000 are or have been available on the EU food market. Mintel started covering the EU food market in 1996, currently covering 20 EU Member States and Norway.

Factor f3 represents the fraction of food items containing the ingredient of interest (as declared on the product label) within the total food category searched. For example, only a certain fraction of biscuits within the overall category of 'biscuits with cream filling' are likely to contain coffee. Factor f3 hence equals the number of biscuits declaring coffee as ingredient divided by the total number of biscuits listed in the food category.

As well as publishing the input parameters, process-specific calculators of the food enzyme intake models (FEIM) have also been developed on the basis of summary statistics. These calculators are deposited at <https://zenodo.org/> for open access and can be downloaded at the following links.

- FEIM_baking <https://doi.org/10.5281/zenodo.4382037>
- FEIM_brewing <https://doi.org/10.5281/zenodo.4382046>
- FEIM_cereal <https://doi.org/10.5281/zenodo.4382057>
- FEIM_egg <https://doi.org/10.5281/zenodo.4353056>
- FEIM_molasses <https://doi.org/10.5281/zenodo.4354558>
- FEIM_modified fats <https://doi.org/10.5281/zenodo.4354782>

Yearly updates have been made also to these FEIM calculators. The updates reflect the continuous expansion of consumption data, specifically, dietary surveys in the EFSA Comprehensive Food Consumption Database.

3.1. Baking processes

This process is defined according to the 'EC working document on food processes in which food enzymes are used' as the following⁴:

Baking processes are those which rely on flour as the principal raw material and lead to the production of foodstuffs such as, but not limited to, bread, biscuits, cakes, pastries, tortillas and baking specialties. Food enzymes are usually added during the mixing of the dough ingredients.

⁴ Unpublished at the time of this publication - Disclaimer: The document has not been officially adopted nor endorsed by the European Commission and it represents the preliminary views of the Commission services.

Following the open call for baking processes,⁵ responses were received from the European Association of Manufacturers and Formulators of Enzyme Products (AMFEP), the Federation of European Union Manufacturers and Suppliers of Ingredients to the Bakery, Confectionery and Patisserie Industries and the Association of Chocolate, Biscuits and Confectionery Industries of Europe (CAOBISCO). Feedback from these stakeholders was reviewed by the Enzyme Working Group. Technical conversion factors were further aligned with those used in the EFSA RPC Model. The following input data will be used for estimating dietary intake of food enzyme-total organic solids (TOS) in foods relevant to this intended use.

FoodEx code	FoodEx category	f1 (conversion from material to flour) ^(a)	f2 (average flour fraction) ^(b)
A.01	Grains and grain-based products (unspecified)	0.8	1
A.01.03	Grain milling products (unspecified)	1	1
A.01.03.001	Wheat milling products (unspecified)	1	1
A.01.03.001.001	Wheat flour, brown	1	1
A.01.03.001.002	Wheat flour, Durum	1	1
A.01.03.001.003	Wheat flour, white	1	1
A.01.03.001.004	Wheat flour, wholemeal	1	1
A.01.03.001.005	Graham flour	1	1
A.01.03.001.006	Wheat flour, gluten free	1	1
A.01.03.001.014	Wheat starch	1.2	1
A.01.03.002	Rye milling products (unspecified)	1	1
A.01.03.002.001	Rye flour, gluten free	1	1
A.01.03.002.002	Rye flour, light	1	1
A.01.03.002.003	Rye flour, medium	1	1
A.01.03.002.004	Rye flour, wholemeal	1	1
A.01.03.003	Buckwheat milling products (unspecified)	1	1
A.01.03.003.001	Buckwheat flour	1	1
A.01.03.004	Corn milling products (unspecified)	1	1
A.01.03.004.001	Corn flour	1	1
A.01.03.004.003	Corn starch	1.3	1
A.01.03.005	Oat milling products (unspecified)	1	1
A.01.03.005.002	Oat flour	1	1
A.01.03.005.004	Oat starch	1.2	1
A.01.03.006	Rice milling products (unspecified)	1	1
A.01.03.006.001	Rice flour	1	1
A.01.03.006.002	Rice flour white	1	1
A.01.03.006.003	Rice flour, instant	1	1
A.01.03.006.004	Rice starch	1.2	1
A.01.03.007	Spelt milling products	1	1
A.01.03.008	Other milling products (unspecified)	1	1
A.01.03.008.001	Amaranth flour	1	1
A.01.03.008.002	Barley flour	1	1
A.01.03.008.003	Chapatti flour	1	1
A.01.03.008.004	Flour mix, wheat/rye/barley/oats	1	1
A.01.03.008.005	Millet flour	1	1
A.01.03.008.007	Sorghum flour	1	1
A.01.04	Bread and rolls (unspecified)	1	0.7
A.01.04.001	Wheat bread and rolls	1	0.7
A.01.04.002	Rye bread and rolls	1	0.7

⁵ <https://www.efsa.europa.eu/en/data/call/161110>

FoodEx code	FoodEx category	f1 (conversion from material to flour) ^(a)	f2 (average flour fraction) ^(b)
A.01.04.003	Mixed wheat and rye bread and rolls	1	0.7
A.01.04.004	Multigrain bread and rolls	1	0.7
A.01.04.005	Unleavened bread, crisp bread and rusk (unspecified)	1	0.9
A.01.04.005.001	Crisp bread, rye wholemeal	1	0.9
A.01.04.005.002	Crisp bread, rye, light	1	0.9
A.01.04.005.003	Crisp bread, wheat, wholemeal	1	0.9
A.01.04.005.004	Crisp bread, wheat, light	1	0.9
A.01.04.005.005	Rusk, light	1	0.9
A.01.04.005.006	Rusk, wholemeal	1	0.9
A.01.04.005.007	Pita bread	1	0.7
A.01.04.005.008	Matzo	1	0.9
A.01.04.005.009	Tortilla	1	0.7
A.01.04.006	Other bread	1	0.7
A.01.04.007	Bread products	1	0.7
A.01.07	Fine bakery wares (unspecified)	1	0.32
A.01.07.001	Pastries and cakes (unspecified)	1	0.22
A.01.07.001.001	Beignets	1	0.30
A.01.07.001.002	Buns	1	0.51
A.01.07.001.003	Cake from batter	1	0.25
A.01.07.001.004	Cheese cream cake	1	0.20
A.01.07.001.005	Cheese cream sponge cake	1	0.18
A.01.07.001.006	Chocolate cake	1	0.24
A.01.07.001.007	Chocolate cake with fruits	1	0.17
A.01.07.001.008	Cream cake	1	0.27
A.01.07.001.009	Cream cheese cake	1	0.20
A.01.07.001.010	Cream custard cake	1	0.20
A.01.07.001.011	Cream custard sponge cake	1	0.05
A.01.07.001.012	Croissant	1	0.52
A.01.07.001.013	Croissant, filled with chocolate	1	0.33
A.01.07.001.014	Croissant, filled with cream	1	0.33
A.01.07.001.015	Croissant, filled with jam	1	0.33
A.01.07.001.016	Croquembouche	1	0.07
A.01.07.001.017	Doughnuts	1	0.36
A.01.07.001.018	Clair	1	0.07
A.01.07.001.020	Fruit cake	1	0.15
A.01.07.001.021	Fruit pie	1	0.32
A.01.07.001.022	Cheese pie	1	0.32
A.01.07.001.023	Fruit tart	1	0.20
A.01.07.001.024	Gingerbread	1	0.41
A.01.07.001.025	Gougere	1	0.18
A.01.07.001.026	Kringles	1	0.20
A.01.07.001.027	Nut cream cake	1	0.15
A.01.07.001.028	Pancakes	1	0.22
A.01.07.001.029	Profiterole	1	0.07
A.01.07.001.030	Pyramid cake	1	0.16
A.01.07.001.031	Rhubarb flan	1	0.15
A.01.07.001.032	Scone	1	0.43
A.01.07.001.033	Sponge dough	1	0.25

FoodEx code	FoodEx category	f1 (conversion from material to flour) ^(a)	f2 (average flour fraction) ^(b)
A.01.07.001.034	Sponge cake	1	0.25
A.01.07.001.035	Sponge cake roll	1	0.18
A.01.07.001.036	Muffins	1	0.31
A.01.07.001.037	Waffles	1	0.36
A.01.07.001.038	Apple strudel	1	0.24
A.01.07.001.039	Cream-cheese strudel	1	0.24
A.01.07.001.040	Cheese pastry goods from puff pastry	1	0.26
A.01.07.001.041	Croissant from puff pastry	1	0.52
A.01.07.001.042	Brioche	1	0.48
A.01.07.001.044	Lebkuchen	1	0.41
A.01.07.001.045	Dumpling	1	0.45
A.01.07.001.046	Cake marbled, with chocolate	1	0.24
A.01.07.001.047	Marzipan pie	1	0.19
A.01.07.001.048	Baklava	1	0.19
A.01.07.002	Biscuits (cookies)	1	0.60
A.01.07.002.001	Biscuits, sweet, plain	1	0.59
A.01.07.002.002	Biscuits, chocolate filling	1	0.42
A.01.07.002.003	Biscuits, cream filling	1	0.42
A.01.07.002.004	Biscuits, fruit filling	1	0.42
A.01.07.002.005	Biscuits, vanilla filling	1	0.42
A.01.07.002.006	Butter biscuits	1	0.59
A.01.07.002.007	Biscuit, iced	1	0.41
A.01.07.002.008	Speculaas	1	0.47
A.01.07.002.009	Biscuits, sweet, wheat wholemeal	1	0.59
A.01.07.002.010	Biscuits, oat meal	1	0.59
A.01.07.002.011	Biscuits, spelt meal	1	0.59
A.01.07.002.012	Biscuits, salty	1	0.67
A.01.07.002.013	Biscuits, salty, with cheese	1	0.60
A.01.07.002.014	Sticks, salty	1	0.79
A.17.05.003	Biscuits, rusks and cookies for children	1	0.59
A.18.04.001	Fine bakery products for diabetics	1	0.32
A.19.01.001	Sandwich and sandwich-like meal	1	0.32
A.19.01.002	Pizza and pizza-like pies	1	0.30

(a): Conversion factor from the raw material to which the food enzyme is typically added (e.g. starch, flour) to flour. Available at: <https://www.fao.org/fileadmin/templates/ess/documents/methodology/tcf.pdf>

(b): Conversion factor accounting for the amount of flour present in the (composite) food. Derived from publically available recipe information and/or food label information (such as Mintel's Global New Products Database <https://www.mintel.com/global-new-products-database>), as well as feedback from stakeholders and aligned with factors used in the RPC model.

3.2. Brewing processes

This process is defined according to the 'EC working document on food processes in which food enzymes are used' as the following⁴:

Brewing processes are those which rely on cereals as the principal raw material, and following a fermentation, lead to the production of beer or other cereal-based beverages.

Following the open call for brewing processes,⁵ responses were received from the Brewers of Europe. Feedback from the stakeholder was reviewed by the Enzyme Working group. Technical conversion factors were further aligned with those used in the EFSA RPC Model. The following input data will be used for estimating dietary intake of food enzyme-TOS in foods relevant to this intended use.

FoodEx code	FoodEx category	f1 (conversion from barley malt to barley grain) ^(a)	f2 (average barley malt fraction) ^(a)
A.14.01	Beer and beer-like beverage (unspecified)	1.37	0.153
A.14.01.001	Beer, strong	1.37	0.2
A.14.01.002	Beer, regular	1.37	0.153
A.14.01.003	Beer, light (reduced alcohol content)	1.37	0.11
A.14.01.004	Beer, alcohol-free	1.37	0.11
A.14.01.005	Beer-like beverages (malt drink)	1.37	0.153

(a): Available at see <https://www.fao.org/fileadmin/templates/ess/documents/methodology/tcf.pdf>

3.3. Distilled alcohol production

This process is defined according to the 'EC working document on food processes in which food enzymes are used' as the following⁴:

Distilled alcohol production processes are those which rely on starch or other carbohydrate-rich agricultural commodities as raw material and lead to the production of products such as, but not limited to vodka, gin, and whisky. The carbohydrates contained in raw materials is extracted and/or hydrolysed by enzymes, followed by yeast fermentation. The ethanol produced during fermentation is subsequently recovered by distillation.

Foods/ingredients derived through alcohol (distillation) processes, i.e. spirits, are excluded from the dietary exposure calculation, as the presence of residual amounts of TOS after distillation is negligible.

Food enzyme-TOS is not expected to be carried over into the distillate. This assumption was supported by information submitted by AMFEP,⁶ which included a description of the main steps in the manufacturing process of the distilled alcohol production in relation to the addition and inactivation/removal of food enzymes, and analytical data on the final products. When using the total protein as the proxy to consider the residual food enzyme-TOS, it is assumed that the enzymes added to the cereal or potato starch are removed in the final ethyl alcohol.

The Panel considered the evidence as sufficient to conclude that residual amounts of TOS are removed by distillation.

3.4. Starch processing for glucose syrups production and other starch hydrolysates

This process has been adapted from to the 'EC working document on food processes in which food enzymes are used' as the following⁴:

Starch processing relies on starch from various crops (e.g., cereals and potatoes) as the raw material. The starch fraction obtained from the raw material is transformed enzymatically into starch derivatives such as maltodextrins, maltose and glucose syrups and glucose, which are subsequently used in a variety of food products.

Glucose syrups derived through starch processing are excluded from dietary exposure calculation, as the presence of residual amounts of TOS after filtration and purification during processing is negligible.

Production of carbohydrate-rich syrups for food use typically involves decolourisation with activated charcoal or similar and treatment with ion-exchange resins. These purification processes are expected to remove food enzyme-TOS from the final food product. This assumption was supported by information submitted by AMFEP and Starch Europe,⁷ which included a description of the main steps of the manufacturing process of the glucose syrups production in relation to the addition and inactivation/removal of food enzymes, and analytical data on the intermediate products and final ingredients of wheat glucose syrup. When using the total protein and true protein-specific nitrogen as the proxy to consider the residual food enzyme-TOS, it is estimated that 99.35–99.97% of enzymes

⁶ Information on 'Food enzyme removal during the production of cereal-based distilled alcoholic beverages'. February 2017.

⁷ Information on 'Food enzyme carry-over in glucose syrups'. February 2017.

added to wheat starch are removed in the commercial syrup. The Panel considered the evidence as sufficient to conclude that residual amounts of TOS are removed by the purification steps applied during the production of glucose syrups (by > 99%), i.e. filtration, ion exchange chromatography, treatment with active carbon and crystallisation.

Depending on the enzymes used to hydrolyse the starch and the extent of the hydrolysis, syrups containing different proportions of mono-, di- and oligosaccharides with varying degree of polymerisation can be obtained. In the food enzyme dossiers received, these products are referred to as starch syrup, glucose syrup, high-maltose glucose syrups, maltodextrin, maltose, etc.

As all these products are obtained from starch and the purification steps applied during their production are virtually the same as for glucose syrup, for which TOS removal has been demonstrated in food enzyme dossiers evaluated, the Panel decided to exclude also these types of starch hydrolysates from the exposure calculation.

3.5. Cereal-based processes

This process has been adapted from the 'EC working document on food processes in which food enzymes are used' as the following⁴:

Cereal-based processes rely on flour as the principal raw material and lead to the production of products such as, but not limited to, pasta, noodles, breakfast cereals and snacks (e.g. muesli bars, popcorn, maize and rice crisps), extruded and/or puffed cereals.

Following the open call for cereal-based processes,⁸ no response was received from any stakeholder. Technical conversion factors were aligned with those used in the EFSA RPC Model. The following input data were used to estimate dietary intake of food enzyme-TOS in foods relevant to this intended use.

FoodEx code	FoodEx category	f1 (conversion from material to flour) ^(a)	f2 (average flour fraction) ^(b)
A.01.05	Pasta (Raw) (unspecified)	1.00	1.00
A.01.05.001	Glass noodle	1.00	1.00
A.01.05.002	Noodle, rice	1.00	1.00
A.01.05.003	Noodle, wheat flour, with eggs	1.00	0.80
A.01.05.004	Noodle, wheat flour, without eggs	1.00	1.00
A.01.05.005	Pasta, wheat flour, with eggs	1.00	0.80
A.01.05.006	Pasta, wheat flour, without eggs	1.00	1.00
A.01.05.007	Pasta, wheat flour, filled	1.00	0.60
A.01.05.008	Pasta, mixed cereal flour	1.00	1.00
A.01.05.009	Pasta, rye flour	1.00	1.00
A.01.05.010	Pasta, soy flour	1.00	1.00
A.01.05.011	Pasta, spelt flour	1.00	1.00
A.01.05.012	Pasta, spelt wholemeal	1.00	1.00
A.01.05.013	Pasta, wheat wholemeal, without eggs	1.00	1.00
A.01.05.014	Pasta, wheat wholemeal, with eggs	1.00	0.80
A.01.05.015	Pasta, gluten free	1.00	1.00
A.01.06	Breakfast cereals (unspecified)	1.00	0.65
A.01.06.001	Cereal flakes (unspecified)	1.00	0.65
A.01.06.005	Mixed breakfast cereals	1.00	0.65
A.01.06.005.001	Breakfast cereals, mixed cereals and fruits	1.00	0.60
A.01.06.005.002	Breakfast cereals, mixed cereals and honey	1.00	0.75
A.01.06.005.003	Breakfast cereals, mixed cereals and nuts	1.00	0.66
A.01.06.005.004	Breakfast cereals, mixed cereals with honey and fruits	1.00	0.60
A.01.06.005.005	Breakfast cereals, mixed cereals, fruits and chocolate	1.00	0.49

⁸ <https://www.efsa.europa.eu/en/data/call/171130>

FoodEx code	FoodEx category	f1 (conversion from material to flour) ^(a)	f2 (average flour fraction) ^(b)
A.01.06.005.006	Breakfast cereals, mixed cereals, fruits, nuts and chocolate	1.00	0.43
A.17.03.004	Pasta for children (unspecified)	1.00	1.00
A.17.04	Ready-to-eat meal for infants and young children	1.00	0.10
A.17.04.002	Ready-to-eat meal for children, cereal-based	1.00	0.15
A.19.01	Cereal-based dishes (unspecified)	1.00	0.25
A.19.01.003	Pasta, cooked (unspecified)	1.00	0.25
A.19.01.003.001	Pasta, cooked, with vegetables	1.00	0.25
A.19.01.003.002	Pasta, cooked, with cheese/cream	1.00	0.25
A.19.01.003.003	Pasta, cooked, with vegetables and cheese/cream	1.00	0.25
A.19.01.003.004	Pasta, cooked, meat filling	1.00	0.25
A.19.01.003.005	Pasta, cooked, vegetable filling	1.00	0.25
A.19.01.003.006	Pasta, cooked, meat and vegetable filling	1.00	0.25

(a): Conversion factor from the raw material to which the food enzyme is typically added (e.g. flour) to flour. Available at see <https://www.fao.org/fileadmin/templates/ess/documents/methodology/tcf.pdf>

(b): Conversion factor accounting for the amount of flour present in the (composite) food. Derived from publicly available recipe information and/or food label information (such as Mintel's Global New Products Database <https://www.mintel.com/global-new-products-database>), and aligned with factors used in the RAC model.

3.6. Grain treatment for the production of starch and gluten fractions

This process has been adapted from the 'EC working document on food processes in which food enzymes are used' as the following⁴:

Grain treatment is the process whereby cereals (grains or grist) are milled and processed in order to be fractionated into starch, gluten and solubles. The separated fractions are then further processed, notably the starch fraction which is either used as a food ingredient (e.g. in baking) or transformed enzymatically into starch derivatives such as maltodextrins, modified starch, glucose syrups and dextrose (glucose) which are themselves used in a number of food products.

The technical information provided by AMFEP⁹ clarified that milled grains are further processed and fractionated into starch, gluten and solubles. Solubles are not used in food production, rather they are generally used in animal feed and as starting material for ethanol production. Therefore, the fraction 'solubles' is not further considered.

Starch and gluten fractions obtained following grain treatment are excluded from dietary exposure calculation, as the presence of residual amounts of TOS after repeated washing during production is negligible.

This assumption was supported by information submitted by AMFEP and Starch Europe,¹² which included (i) a description of the main steps of the production process of the different fractions in relation to the addition and removal of food enzymes, (ii) theoretical calculations based on measured amounts of intermediate and final fractions and (iii) measurement of enzymatic activities for several different food enzymes in the weighed intermediate and final products (e.g. process water, dough, tricanter feed, crude starch, crude and dry gluten). When using both the final calculated residual amount and measured enzyme activity in the final products, respectively, it is estimated that > 99% of enzyme added to the raw material (e.g. grain, flour) are removed during production.

The Panel considered the evidence as sufficient to conclude that residual amounts of TOS are removed by the washing steps applied during the production of the starch and gluten fractions (by > 99%).

3.7. Manufacture of speciality carbohydrates

This process has been adapted from to the 'EC working document on food processes in which food enzymes are used' as the following⁴:

⁹ Information on 'Grain processing / Fate of the food enzymes'. April 2018 and July 2018.

Carbohydrate processing and conversion rely on disaccharides or oligosaccharides (e.g., sucrose, lactose, inulin) or glucose syrups as the principal raw material and lead to the production of products such as, but not limited to, substitutes for fructo-oligosaccharides, galacto-oligosaccharides and glucose-fructose syrups.

The food enzyme maybe be used in free form or as an immobilised preparation. When immobilised, the carry-over of TOS into the speciality carbohydrates is likely to be reduced.¹⁰ Independent of the methods of application, the final products undergo extensive purification.

Nonetheless, as different approaches to immobilising food enzymes are in use, and are often specific to the individual application, the Panel decided to request the relevant technical information and/or experimental data on a case-by-case basis.

3.8. Coffee bean demucilation

This process has been adapted from the 'EC working document on food processes in which food enzymes are used' as the following⁴:

Coffee processing relies on raw coffee cherries as the principal raw material. Demucilation is the removal of the mucilage coat surrounding the coffee cherries in the fermentation step which may be accelerated by the enzymatic treatment.

The resulting product, *i.e.* green coffee beans, is excluded from the dietary exposure calculation, as the presence of residual TOS after demucilation is negligible.

This assumption was supported by information submitted by AMFEP,¹¹ which included (i) a description of the main steps employed in coffee processing from the harvested coffee cherries to soluble ground coffee, and (ii) in relation to the addition and inactivation/removal of food enzymes, measurement of enzymatic activity for two different food enzymes on the surface of the harvested coffee cherries, intermediate coffee bean under fermentation and final green coffee beans.

Although it was not possible to quantify the extent of TOS removal based on the residual enzyme activity measured, the Panel considered the fact that the food enzyme is used only on the coat of the raw coffee cherries to aid removal of same and followed by washing steps as sufficient to conclude that enzymes are removed during mucilation of coffee beans.

3.9. Coffee processing

This process has been adapted from the 'EC working document on food processes in which food enzymes are used' as the following⁴:

Coffee processing relies on demucilaged coffee beans as the principal raw material and covers any aspect of coffee processing after the fermentation step.

Following the open call for coffee processing,¹² feedback was received from the European Coffee Federation. The following input data were used to estimate dietary exposure to food enzyme-TOS in foods relevant to this intended use.

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Conversion from roasted coffee bean to raw material (coffee bean, green))	f2 (Average fraction of roasted coffee bean in respective FoodEx category)	f3 (Percentage of FoodEx category containing coffee as ingredient)
A.01.06	Breakfast cereals (unspecified)	4	1.19	0.020	0.01
A.01.06.002	Muesli (unspecified)	4	1.19	0.020	0.01
A.01.06.002.001	Muesli bars	4	1.19	0.023	0.01

¹⁰ Information on 'Transfer of enzymes into food, for refined sugar production and processing', provided by AMFEP. October 2017.

¹¹ Information on 'Coffee processing/demucilation'. September 2019.

¹² <https://www.efsa.europa.eu/en/consultations/call/190617>

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Conversion from roasted coffee bean to raw material (coffee bean, green))	f2 (Average fraction of roasted coffee bean in respective FoodEx category)	f3 (Percentage of FoodEx category containing coffee as ingredient)
A.01.06.002.002	Muesli with added sugar	4	1.19	0.023	0.01
A.01.06.002.003	Muesli with chocolate	4	1.19	0.023	0.01
A.01.06.002.004	Muesli with fruits	4	1.19	0.023	0.01
A.01.06.002.005	Muesli with fruits and chocolate	4	1.19	0.023	0.01
A.01.06.002.006	Muesli with fruits and nuts	4	1.19	0.023	0.01
A.01.06.002.007	Muesli with fruits, nuts and chocolate	4	1.19	0.023	0.01
A.01.06.002.008	Muesli, mixed	4	1.19	0.023	0.01
A.01.06.002.009	Muesli, no added sugar	4	1.19	0.023	0.01
A.01.06.003	Cereal bars (unspecified)	4	1.19	0.020	0.01
A.01.06.003.001	Cereal bar with fruits	4	1.19	0.021	0.01
A.01.06.003.002	Cereal bar with added sugar	4	1.19	0.021	0.01
A.01.06.003.003	Cereal bar with chocolate	4	1.19	0.021	0.01
A.01.06.003.004	Cereal bar, with no added sugar	4	1.19	0.021	0.01
A.01.07	Fine bakery wares (unspecified)	4	1.19	0.001	0.01
A.01.07.001	Pastries and cakes (unspecified)	4	1.19	0.001	0.01
A.01.07.001.004	Cheese cream cake	4	1.19	0.005	0.01
A.01.07.001.005	Cheese cream sponge cake	4	1.19	0.005	0.01
A.01.07.001.008	Cream cake	4	1.19	0.001	0.01
A.01.07.001.010	Cream custard cake	4	1.19	0.001	0.01
A.01.07.001.011	Cream custard sponge cake	4	1.19	0.001	0.01
A.01.07.001.014	Croissant, filled with cream	4	1.19	0.001	0.01
A.01.07.001.016	Croquembouche	4	1.19	0.001	0.01
A.01.07.001.018	Éclair	4	1.19	0.001	0.01
A.01.07.001.019	Flan	4	1.19	0.007	0.01
A.01.07.001.027	Nut cream cake	4	1.19	0.001	0.01
A.01.07.001.029	Profiterole	4	1.19	0.001	0.01
A.01.07.001.035	Sponge cake roll	4	1.19	0.001	0.01
A.01.07.001.037	Waffles	4	1.19	0.010	0.01
A.01.07.001.043	Macaroons	4	1.19	0.0002	0.01
A.01.07.002	Biscuits (cookies) (unspecified)	4	1.19	0.001	0.01

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Conversion from roasted coffee bean to raw material (coffee bean, green))	f2 (Average fraction of roasted coffee bean in respective FoodEx category)	f3 (Percentage of FoodEx category containing coffee as ingredient)
A.01.07.002.002	Biscuits, chocolate filling	4	1.19	0.001	0.01
A.01.07.002.003	Biscuits, cream filling	4	1.19	0.001	0.01
A.01.07.002.005	Biscuits, vanilla filling	4	1.19	0.001	0.01
A.02.12	Coffee beans and coffee products (Solid) (unspecified)	4	1.19	1.000	1
A.02.12.001	Coffee beans	4	1.19	1.000	1
A.02.12.002	Coffee beans, roasted	4	1.19	1.000	1
A.02.12.003	Coffee beans, roasted, decaffeinated	4	1.19	1.05	1
A.02.12.004	Coffee beans, roasted and ground	4	1.19	1.000	1
A.02.12.005	Coffee beans, roasted and ground, decaffeinated	4	1.19	1.05	1
A.02.12.006	Instant coffee, powder	4	1.19	2.6	1
A.02.12.007	Instant coffee, powder, decaffeinated	4	1.19	2.73	1
A.08.02.001	Flavoured milk (unspecified)	4	1.19	0.007	0.01
A.08.02.001.002	Chocolate and fruit-flavoured milk	4	1.19	0.007	0.01
A.08.02.002	Milkshakes (unspecified)	4	1.19	0.007	0.01
A.08.02.002.001	Chocolate milkshake	4	1.19	0.007	0.01
A.08.06.002	Yoghurt, cow milk, with fruit (unspecified)	4	1.19	0.007	0.01
A.08.06.002.001	Yoghurt, cow milk, with fruit, > 3% fat	4	1.19	0.007	0.01
A.08.06.002.002	Yoghurt cow milk, with fruit, 1–3% fat	4	1.19	0.007	0.01
A.08.06.002.003	Yoghurt, cow milk, with fruit, < 1% fat	4	1.19	0.007	0.01
A.10.03	Chocolate (Cocoa) products (unspecified)	4	1.19	0.030	0.01
A.10.03.001	Bitter chocolate	4	1.19	0.035	0.01
A.10.03.002	Bitter-sweet chocolate	4	1.19	0.035	0.01

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Conversion from roasted coffee bean to raw material (coffee bean, green))	f2 (Average fraction of roasted coffee bean in respective FoodEx category)	f3 (Percentage of FoodEx category containing coffee as ingredient)
A.10.03.003	Chocolate bar	4	1.19	0.035	0.01
A.10.03.004	Chocolate, cream	4	1.19	0.035	0.01
A.10.03.005	Chocolate with nuts or fruits	4	1.19	0.035	0.01
A.10.03.006	Chocolate-coated confectionery	4	1.19	0.035	0.01
A.10.03.007	Filled chocolate	4	1.19	0.035	0.01
A.10.03.008	Milk chocolate	4	1.19	0.035	0.01
A.10.03.009	White chocolate	4	1.19	0.035	0.01
A.10.03.010	Pralines	4	1.19	0.035	0.01
A.10.03.011	Cooking chocolate	4	1.19	0.035	0.01
A.10.03.012	Cooking chocolate, white	4	1.19	0.035	0.01
A.10.03.013	Dietetic chocolate	4	1.19	0.035	0.01
A.10.03.014	Chocolate substitutes	4	1.19	0.035	0.01
A.10.04	Confectionery (non-chocolate) (unspecified)	4	1.19	0.030	0.01
A.10.04.001	Candies, with sugar	4	1.19	0.032	0.01
A.10.04.002	Candies, sugar free	4	1.19	0.032	0.01
A.10.04.003	Marzipan	4	1.19	0.032	0.01
A.10.04.004	Caramel, hard	4	1.19	0.032	0.01
A.10.04.005	Caramel, soft	4	1.19	0.032	0.01
A.10.04.006	Toffee	4	1.19	0.032	0.01
A.10.04.007	Fudge	4	1.19	0.032	0.01
A.10.04.008	Dragée, sugar coated	4	1.19	0.032	0.01
A.10.04.011	Liquorice candies	4	1.19	0.032	0.01
A.10.04.012	Gum drops	4	1.19	0.032	0.01
A.10.04.014	Nougat	4	1.19	0.032	0.01
A.13.03	Coffee (Beverage) (unspecified)	4	1.19	0.050	1
A.13.03.001	Coffee drink, espresso	4	1.19	0.143	1
A.13.03.002	Coffee drink, café americano	4	1.19	0.056	1
A.13.03.003	Coffee drink, cappuccino	4	1.19	0.056	1
A.13.03.004	Coffee drink, café macchiato	4	1.19	0.143	1
A.13.03.005	Iced coffee	4	1.19	0.056	1
A.13.03.006	Coffee with milk (café latte, café au lait)	4	1.19	0.056	1
A.13.03.007	Instant coffee, liquid	4	1.19	0.042	1

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Conversion from roasted coffee bean to raw material (coffee bean, green))	f2 (Average fraction of roasted coffee bean in respective FoodEx category)	f3 (Percentage of FoodEx category containing coffee as ingredient)
A.14.05	Liqueur (unspecified)	4	1.19	0.007	0.01
A.14.05.004	Coffee liqueur	4	1.19	0.007	1
A.20.02	Ices and desserts (unspecified)	4	1.19	0.006	0.01
A.20.02.001	Ice cream, milk-based	4	1.19	0.009	0.01
A.20.02.002	Ice cream, not milk-based	4	1.19	0.009	0.01
A.20.02.003	Starchy pudding	4	1.19	0.007	0.01
A.20.02.004	Custard	4	1.19	0.007	0.01
A.20.02.007	Granita	4	1.19	0.007	0.01
I.20.02.009	Tiramisù	4	1.19	0.023	1

3.10. Wine and wine vinegar production

This process has been adapted from the 'EC working document on food processes in which food enzymes are used' as the following⁴:

Wine making processes rely on grapes as the main raw material in the production of wine and wine vinegar. The process involves fermentation of grapes or grape musts with yeast, optionally followed by a malolactic fermentation with bacteria.

Following the open call for wine production,¹² no response was received from any stakeholder. The following input data were used to estimate dietary intake of food enzyme-TOS in foods relevant to this intended use.

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Conversion from wine or wine vinegar to raw material (grape))	f2 (Average fraction of wine or wine vinegar in respective FoodEx category)	f3 (Percentage of FoodEx category containing wine or wine vinegar)
A.05.04.002	Wine grapes	4	1	1.000	1
A.05.09.009	Fruit in vinegar, oil, or brine	4	1	0.138	1
A.06.09.001	Fresh and lightly cooked sausage (unspecified)	4	1.43	0.010	0.2
A.06.09.001.001	Salsiccia	4	1.43	0.010	1
A.06.09.006	Dry sausage (unspecified)	4	1.43	0.014	0.08
A.06.09.006.009	Hungarian-type salami	4	1.43	0.014	1
A.06.11.001	Meat paste (unspecified)	4	1	0.002	1
I.06.11.001.001	Meat paste, Poultry	4	1	0.002	1
A.07.02.005	Fish pâté (unspecified)	4	1	0.006	0.25

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Conversion from wine or wine vinegar to raw material (grape))	f2 (Average fraction of wine or wine vinegar in respective FoodEx category)	f3 (Percentage of FoodEx category containing wine or wine vinegar)
I.07.02.005.001	Fish pâté, Mackerel	4	1	0.024	1
I.07.02.005.004	Fish pâté, Tuna	4	1	0.006	1
A.10.05	Dessert sauces (unspecified)	4	1.43	0.410	0.25
A.10.05.004	Alcoholic sweet sauce	4	1.43	0.410	1
A.14.02	Wine (unspecified)	4	1.43	1.000	1
A.14.02.001	Wine, white	4	1.43	1.000	1
A.14.02.002	Wine, white, sparkling	4	1.43	1.000	1
A.14.02.003	Wine, red	4	1.43	1.000	1
A.14.02.004	Wine, red, sparkling	4	1.43	1.000	1
A.14.03	Fortified and liqueur wines (e.g. Vermouth, Sherry, Madeira) (unspecified)	4	1.43	0.800	1
A.14.03.001	Vermouth	4	1.43	0.906	1
A.14.03.002	Sherry	4	1.43	0.800	1
A.14.07.001	Cocktail drink (unspecified)	4	1.43	0.700	1
I.14.07.001.001	Kir	4	1.43	0.900	1
I.14.07.001.003	Sangria	4	1.43	0.671	1
A.16.05	Condiment (unspecified)	4	1	0.030	1
A.16.05.001	Mustard, sweet	4	1	0.180	1
A.16.05.002	Mustard, mild	4	1	0.150	1
A.16.05.003	Mustard, hot	4	1	0.270	1
A.16.05.004	Vinegar, wine	4	1	1.000	1
A.16.05.006	Tomato ketchup	4	1	0.120	1
A.16.05.007	Barbecue sauce	4	1	0.059	1
A.16.05.008	Tabasco sauce	4	1	0.480	1
A.16.05.009	Horseradish sauce	4	1	0.034	1
A.16.05.010	Mint sauce	4	1	0.800	1
A.16.05.012	Curry sauce	4	1	0.061	1
A.16.05.014	Tartar sauce	4	1	0.033	1
A.16.05.015	Mixed condiment	4	1	0.060	1
A.16.06	Dressing (unspecified)	4	1	0.030	1
A.16.06.001	Salad dressing, > 50% oil	4	1	0.210	1
A.16.06.002	Salad dressing, 25–50% oil	4	1	0.524	1
A.16.06.003	Salad dressing, < 25% oil	4	1	0.630	1
A.16.06.004	Mayonnaise, > 50% oil	4	1	0.041	1

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Conversion from wine or wine vinegar to raw material (grape))	f2 (Average fraction of wine or wine vinegar in respective FoodEx category)	f3 (Percentage of FoodEx category containing wine or wine vinegar)
A.16.06.005	Mayonnaise, 25–50% oil	4	1	0.033	1
A.16.06.006	Mayonnaise, < 25% oil	4	1	0.049	1
I.16.06.007	Salad dressing (unspecified)	4	1	0.305	1
I.16.06.008	Yogonaise	4	1	0.028	1
I.16.06.009	Thousand Islands sauce	4	1	0.130	1
A.16.07	Chutney and pickles (unspecified)	4	1	0.001	1
A.16.07.001	Tomato chutney	4	1	0.100	1
A.16.07.002	Apple chutney	4	1	0.100	1
A.16.07.003	Cucumber chutney	4	1	0.100	1
A.16.07.004	Mango chutney	4	1	0.100	1
A.16.07.005	Mixed chutney	4	1.43	0.320	1
A.16.07.005	Mixed chutney	4	1	0.001	1
A.16.07.006	Piccalilli	4	1	0.023	1
A.16.07.007	Chilli pickle	4	1	0.100	1
A.16.07.008	Lime pickle	4	1	0.085	1
A.16.07.009	Mango pickle	4	1	0.006	1
A.16.07.010	Mixed pickle	4	1	0.060	1
A.16.07.011	Relish	4	1	0.107	1
A.16.08	Savoury sauces (unspecified)	4	1.43	0.020	1
A.16.08.003	Cream sauce (unspecified)	4	1.43	0.180	1
I.16.08.003.005	Dill sauce	4	1.43	0.179	1
A.16.08.005	Emulsion sauce (Hollandaise sauce) (unspecified)	4	1	0.003	1
I.16.08.005.001	Sauce béarnaise	4	1	0.109	1
I.16.08.005.002	Sauce hollandaise	4	1	0.003	1
A.16.08.006	Oil-based sauce (Pesto, Aioli sauce) (unspecified)	4	1	0.031	0.25
I.16.08.006.001	Aioli	4	1	0.031	1
A.16.08.007	Alcoholic sauce (unspecified)	4	1.43	0.100	1
I.16.08.007.002	Red wine sauce	4	1.43	0.521	1
I.16.08.007.003	White wine sauce	4	1.43	0.180	1
A.16.08.008	Meat sauce (unspecified)	4	1.43	0.050	0.5
I.16.08.008.001	Bolognese sauce	4	1.43	0.050	1
I.16.08.008.004	Meat sauce, with sausage	4	1.43	0.060	1
A.16.08.010	Vegetable sauce (unspecified)	4	1	0.003	0.1

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Conversion from wine or wine vinegar to raw material (grape))	f2 (Average fraction of wine or wine vinegar in respective FoodEx category)	f3 (Percentage of FoodEx category containing wine or wine vinegar)
I.16.08.010.001	Bean sauce	4	1	0.050	1
I.16.08.010.002	Mushroom sauce	4	1.43	0.020	1
I.16.08.010.003	Mustard sauce	4	1	0.215	1
I.16.08.010.005	Peanut sauce	4	1	0.003	1
I.16.08.010.006	Pepper sauce	4	1.43	0.120	1
I.16.08.010.007	Sweet and sour sauce	4	1	0.118	1
A.19.01.001	Sandwich and sandwich-like meal (unspecified)	4	1	0.004	1
A.19.01.001.002	Sandwich, meat filling (unspecified)	4	1	0.004	1
I.19.01.001.009	Cheeseburger	4	1	0.008	1
I.19.01.001.011	Hamburger	4	1	0.004	1
I.19.01.001.012	Doner kebab	4	1	0.008	1
I.19.01.001.014	Sausage roll	4	1.43	0.005	1
I.19.01.001.014	Sausage roll	4	1	0.009	1
A.19.01.001.003	Sandwich, fish filling	4	1	0.005	1
A.19.01.001.007	Sandwich, meat and vegetable filling	4	1.43	0.020	1
A.19.01.001.008	Sandwich, fish and vegetable filling	4	1	0.004	1
I.19.01.001.010	Double burger	4	1	0.006	1
I.19.01.001.013	Hot dog	4	1	0.017	1
I.19.01.001.016	Fish burger	4	1	0.015	1
A.19.01.003	Pasta, cooked (unspecified)	4	1.43	0.020	0.2
A.19.01.003.004	Pasta, cooked, meat filling	4	1.43	0.020	0.05
A.19.01.003.006	Pasta, cooked, meat and vegetable filling	4	1.43	0.020	1
I.19.01.003.007	Pasta, cooked, with bolognese sauce	4	1.43	0.029	1
I.19.01.003.017	Lasagna/Canelloni, with meat	4	1.43	0.025	1
A.19.02.003	Rice, meat and vegetables meal	4	1	0.013	1
A.19.03.002	Potatoes and meat meal (unspecified)	4	1.43	0.019	0.17
I.19.03.002.004	Potato sausage meal	4	1.43	0.019	1
A.19.03.003	Potatoes, meat and vegetable meal (unspecified)	4	1.43	0.016	0.33
I.19.03.003.001	Moussaka	4	1.43	0.016	1
A.19.06.002	Fish and rice meal	4	1.43	0.027	1

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Conversion from wine or wine vinegar to raw material (grape))	f2 (Average fraction of wine or wine vinegar in respective FoodEx category)	f3 (Percentage of FoodEx category containing wine or wine vinegar)
A.19.10	Ready to eat soups (unspecified)	4	1.43	0.020	0.2
A.19.10.005	Fish soup	4	1.43	0.076	1
A.19.10.007	Milk product/egg soup	4	1.43	0.020	1
A.19.11	Prepared salads (unspecified)	4	1	0.010	1
A.19.11.001	Prepared green salad	4	1	0.078	1
A.19.11.002	Prepared mixed vegetable salad	4	1	0.078	1
A.19.11.003	Prepared potato salad (unspecified)	4	1	0.009	1
I.19.11.003.001	Potato salad with vinaigrette	4	1	0.055	1
I.19.11.003.002	Potato salad with mayonnaise	4	1	0.009	1
A.19.11.004	Prepared pasta salad	4	1	0.023	1
A.19.11.005	Prepared rice salad	4	1	0.033	1
A.19.11.007	Prepared nut salad	4	1	0.011	1
A.19.11.008	Prepared meat salad	4	1	0.052	1
A.19.11.009	Prepared fish salad	4	1	0.016	1
A.19.11.010	Prepared mixed egg/meat/fish/vegetable salad	4	1	0.049	1
I.20.02.009	Tiramisù	4	1.43	0.050	1

3.11. Egg processing

This process has been adapted from the 'EC working document on food processes in which food enzymes are used' as the following⁴:

Egg processing relies on raw eggs (without shell) and/or components of egg (yolk or egg white) as raw materials and leads to the production of products such as dried or pasteurised egg products.

Following the open call for egg processing,¹³ no response was received from any stakeholder. The following input data were used to estimate dietary intake of food enzyme-TOS in foods relevant to this intended use.

¹³ <https://www.efsa.europa.eu/en/consultations/call/call-input-data-exposure-assessment-food-enzymes-6th-call>

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (converting treated egg component to whole liquid egg)	f2 (average fraction of egg component in respective FoodEx category)
A.01.05	Pasta (Raw) (unspecified)	4	1	0.20
A.01.05.003	Noodle, wheat flour, with eggs	4	1	0.14
A.01.05.005	Pasta, wheat flour, with eggs	4	1	0.20
A.01.05.007	Pasta, wheat flour, filled	4	1	0.20
A.01.05.014	Pasta, wheat wholemeal, with eggs	4	1	0.20
A.01.07	Fine bakery wares (unspecified)	4	1	0.13
A.01.07.001	Pastries and cakes (unspecified)	4	1	0.13
A.01.07.001.001	Beignets	4	1	0.05
A.01.07.001.002	Buns	4	1	0.12
I A.01.07.001.003	Cake from batter	4	1	0.17
A.01.07.001.004	Cheese cream cake	4	1	0.18
A.01.07.001.005	Cheese cream sponge cake	4	1	0.32
A.01.07.001.006	Chocolate cake	4	1	0.10
A.01.07.001.007	Chocolate cake with fruits	4	1	0.15
A.01.07.001.008	Cream cake	4	1	0.15
A.01.07.001.009	Cream cheese cake	4	1	0.18
A.01.07.001.010	Cream custard cake	4	1	0.17
A.01.07.001.011	Cream custard sponge cake	4	1	0.35
A.01.07.001.012	Croissant	4	1	0.13
A.01.07.001.013	Croissant, filled with chocolate	4	1	0.08
A.01.07.001.014	Croissant, filled with cream	4	1	0.08
A.01.07.001.015	Croissant, filled with jam	4	1	0.08
A.01.07.001.016	Croquembouche	4	1	0.17
A.01.07.001.017	Doughnuts	4	1	0.03
A.01.07.001.018	Éclair	4	1	0.20
A.01.07.001.019	Flan	4	1	0.19
A.01.07.001.020	Fruit cake	4	1	0.13
A.01.07.001.021	Fruit pie	4	1	0.10
A.01.07.001.022	Cheese pie	4	1	0.10
A.01.07.001.023	Fruit tart	4	1	0.08
A.01.07.001.024	Gingerbread	4	1	0.07
A.01.07.001.025	Gougere	4	1	0.29
A.01.07.001.026	Kringles	4	1	0.04
A.01.07.001.027	Nut cream cake	4	1	0.12
A.01.07.001.028	Pancakes	4	1	0.12
A.01.07.001.029	Profiterole	4	1	0.17
A.01.07.001.030	Pyramid cake	4	1	0.18
A.01.07.001.031	Rhubarb flan	4	3	0.06
A.01.07.001.032	Scone	4	1	0.06
A.01.07.001.033	Sponge dough	4	1	0.26
A.01.07.001.034	Sponge cake	4	1	0.26
A.01.07.001.035	Sponge cake roll	4	1	0.23
A.01.07.001.036	Muffins	4	1	0.16
A.01.07.001.037	Waffles	4	1	0.14
A.01.07.001.038	Apple strudel	4	1	0.04

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (converting treated egg component to whole liquid egg)	f2 (average fraction of egg component in respective FoodEx category)
A.01.07.001.039	Cream-cheese strudel	4	1	0.01
A.01.07.001.040	Cheese pastry goods from puff pastry	4	1	0.02
A.01.07.001.041	Croissant from puff pastry	4	1	0.13
A.01.07.001.042	Brioche	4	1	0.14
A.01.07.001.043	Macarons	4	1.5	0.11
A.01.07.001.044	Lebkuchen	4	1	0.08
A.01.07.001.045	Dumpling	4	1	0.18
A.01.07.001.046	Cake marbled, with chocolate	4	1	0.17
A.01.07.001.047	Marzipan pie	4	1	0.12
A.01.07.002	Biscuits (cookies) (unspecified)	4	1	0.05
A.01.07.002.001	Biscuits, sweet, plain	4	1	0.05
A.01.07.002.002	Biscuits, chocolate filling	4	1	0.05
A.01.07.002.003	Biscuits, cream filling	4	1	0.05
A.01.07.002.004	Biscuits, fruit filling	4	1	0.05
A.01.07.002.005	Biscuits, vanilla filling	4	1	0.05
A.01.07.002.006	Butter biscuits	4	1	0.04
A.01.07.002.007	Biscuit, iced	4	1	0.08
A.01.07.002.008	Speculaas	4	1	0.08
A.01.07.002.009	Biscuits, sweet, wheat wholemeal	4	1	0.03
A.06.09.001.002	Bratwurst		1.5	0.052
A.06.09.001.004	Weisswurst	4	1.5	0.052
A.06.09.001.005	Bockwurst	4	1.5	0.052
A.07.02.002	Fishcakes	4	1	0.067
A.07.02.003	Fish fingers	4	1	0.067
A.10.05.004	Alcoholic sweet sauce	4	1	0.30
A.16.06	Dressing (unspecific)	4	3	0.02
A.16.06.001	Salad dressing, > 50% oil	4	3	0.05
A.16.06.002	Salad dressing, 25–50% oil	4	3	0.03
A.16.06.003	Salad dressing, < 25% oil	4	3	0.03
A.16.06.004	Mayonnaise, > 50% oil	4	3	0.06
A.16.06.005	Mayonnaise, 25–50% oil	4	3	0.06
A.16.06.006	Mayonnaise, < 25% oil	4	3	0.06
A.19.01.003	Pasta, cooked (unspecified)	4	1	0.12
A.19.01.003.001	Pasta, cooked, with vegetables	4	1	0.12
A.19.01.003.002	Pasta, cooked, with cheese/cream	4	1	0.12
A.19.01.003.003	Pasta, cooked, with vegetables and cheese/cream	4	1	0.12
A.19.01.003.004	Pasta, cooked, meat filling	4	1	0.12
A.19.01.003.005	Pasta, cooked, vegetable filling	4	1	0.12
A.19.01.003.006	Pasta, cooked, meat and vegetable filling	4	1	0.12
A.19.05	Meat-based meals (unspecified)	4	1	0.07
A.19.05.001	Meat burger	4	1	0.07
A.19.05.002	Meat balls	4	1	0.07
A.19.07.006	Vegetable soufflé	4	1	0.29
A.19.11.003	Prepared potato salad	4	3	0.006

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (converting treated egg component to whole liquid egg)	f2 (average fraction of egg component in respective FoodEx category)
A.19.11.004	Prepared pasta salad	4	3	0.006
A.19.11.005	Prepared rice salad	4	3	0.006
A.19.11.006	Prepared legume (beans) salad	4	3	0.006
A.19.11.007	Prepared nut salad	4	3	0.006
A.19.11.008	Prepared meat salad	4	3	0.006
A.19.11.009	Prepared fish salad	4	3	0.006
A.20.02	Ices and desserts (unspecified)	4	3	0.10
A.20.02.001	Ice cream, milk-based	4	3	0.10
A.20.02.003	Starchy pudding	4	3	0.08
A.20.02.004	Custard	4	1	0.17
A.05.08.003	Other fruit spreads	3	1	0.17
A.06.11.001	Meat paste	3	1	0.075
A.06.11.005	Terrine	3	1	0.0458
A.16.08.008	Meat sauce	3	1	0.3692
A.19.03.001	Potato and vegetable meals	3	1	0.072
A.19.04.002	Beans and vegetables meal	3	1.5	0.05

3.12. Modified lecithin production from egg

This process is not listed in the 'EC working document on food processes in which food enzymes are used'; however, applications for this intended use were received by EFSA. For the purpose of this work, the EFSA CEP Panel considers that

This food manufacturing process covers any modification to lecithin designed to improve functionality.

Lecithins (E 322) is an authorised food additive in the EU according to Annex II and Annex III to Regulation (EC) No 1333/2008 on food additives.

In the framework of Regulation (EC) No 1333/2008 on food additives and of Commission Regulation (EU) No 257/2010 regarding the re-evaluation of approved food additives, the ANS panel, in 2017, re-evaluated lecithin used as food additive and in support of this opinion issued public calls for occurrence data (usage level and/or concentration data) on lecithins (E 322). In response to this public call, updated information on the actual use levels of lecithins (E 322) in foods was made available to EFSA by industry.

Since an exposure assessment to lecithins (E 322) was carried out by the EFSA ANS panel as part of the re-evaluation programme and published in 2017,¹⁴ the already derived exposure estimates were combined with the food enzyme use levels in the assessment of exposure to food enzymes used in the production of lecithin.

3.13. Refined and unrefined sugar production

This process has been adapted from the 'EC working document on food processes in which food enzymes are used' as follows⁴:

Sugar production relies on sugar cane and sugar beet as raw material and leads to the production of products such as, but not limited to refined sugar, sugar syrups and molasses.

The resulting food products, refined white beet/cane sugar, are excluded from the dietary exposure calculation, as the presence of residual TOS in the refined sucrose is negligible.

¹⁴ Available at <https://efsa.onlinelibrary.wiley.com/doi/full/10.2903/j.efsa.2017.4742>

This assumption was supported by information submitted by AMFEP,¹⁵ which included a description of the main steps employed in the sugar production from sugar beet. In case of microbial spoilage of beets, dextranase can be added to the beet juice during the diffusion step to breakdown the mucous polymers (dextrans) formed by lactic acid bacteria. During diffusion, sucrose and other beet constituents are extracted from the beet slices. The raw beet juice then undergoes liming and carbonation with carbon dioxide, during the 'juice purification' step. In this step, the precipitating solubles (proteins, beet minerals, amino acids, etc.) are removed from the beet juice by decantation or centrifugation. Sucrose is further purified by discoloration and crystallisation. It is assumed that at least 99% of the enzyme TOS is eliminated during the beet sugar production process.

Similarly, dextranase is used in the production of cane sugar to degrade dextran resulting from microbial spoilage. In addition, alpha-amylase is used to break down starch, present in the cane and carried over into the cane juice. The elimination of the food enzyme-TOS during the cane sugar-making process is also estimated to be at least 99%, according to the European Association of Sugar Manufacturers (CEFS). This assumption was supported by information submitted by CEFS which included a description of the main steps of the manufacturing process of both beet and cane sugar production in relation to the addition and inactivation/removal of food enzymes, and analytical data on the intermediate products and final purified white sugar. When using sucrose content as the proxy to consider the residual food enzyme-TOS, it is estimated that 98.2–99.9% (beet) and 98.7–99.8% (cane) of enzymes added to the raw material are removed in the commercial sugar. The Panel considered the evidence as sufficient to conclude that residual amounts of TOS are removed by the purification steps applied during the production of sugar (by > 98%), i.e. decantation, centrifugation, discoloration and crystallisation.¹⁶

This consideration, however, is not applicable to unrefined beet/cane sugar products, including unrefined sugar, beet molasses and cane syrups. Molasses (also referred to as black treacle) is a by-product of the refined beet sugar production in the form of an uncrystallised syrup. In the EU, molasses is mainly used as animal feed and in biofuels production. However, due to its nutritional value and flavour characteristics, it has also emerged as alternative to sweeten and flavour foods, e.g. breakfast cereals, sauces, bread. Certain products, e.g. Speculaas and Lebkuchen, have traditionally been produced with molasses. Data from the CEFS on the raw beet juice suggest that the beet molasses for human consumption are at least 90% pure.¹⁶ No data was provided to establish the purity of cane syrups.

As the Comprehensive Database does generally not provide information on the raw material used (i.e. cane, beet) to produce the unrefined sugar products, consumption of such products could not be separated into the different categories according to plant source. While it is acknowledged that use of such products may not be equal to each other, in the absence of being able to distinguish products coming from the two different sources, dietary exposure assessment of these products was combined, and which was reflected in the undifferentiated inclusion of both the beet molasses and the unrefined cane syrup in the open call.

Following the open call,¹³ which focused on the possible intake of food enzyme-TOS via consuming unrefined beet/cane sugar products, a response was received from CEFS.¹⁷

CEFS further clarified that 'brown sugar', which is currently not legally defined at EU level, covers a broad range of different sugars with brown colour, and which do not all correspond to raw cane sugar. According to CEFS' members, brown sugars containing cane molasses or caramelised sugar syrup are considered to be niche products in the EU and only make up a small fraction. Such sugars were therefore excluded from the exposure assessment.

The following input data were used to estimate dietary intake of food enzyme-TOS in foods relevant to this intended use.

¹⁵ Information on the transfer of enzymes into foods for refined sugar production and processing. October 2017.

¹⁶ Information on the transfer of enzymes into foods for refined sugar production and processing. October 2020.

¹⁷ Information on 'EFSA call for input data for the exposure assessment of food enzymes: refined sugar production (molasses as a by-product) CEFS comment'. July 2020.

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Converting unrefined sugar product* to sugar beet or cane)	f2 (Average fraction of unrefined sugar product* in respective FoodEx category)	f3 (Percentage of FoodEx category containing unrefined sugar product*)
A.01.04.001.004	Wheat bread, brown	4	35	0.01	0.1
A.01.04.001.005	Wheat bread, brown, gluten free	4	35	0.01	0.1
A.01.04.001.006	Wheat bread, brown, with oil seeds	4	35	0.01	0.1
A.01.04.001.007	Wheat bread, with bran	4	35	0.01	0.1
A.01.04.001.008	Wheat bread, with oil seeds	4	35	0.01	0.1
A.01.04.001.009	Wheat germ bread	4	35	0.01	0.1
A.01.04.001.013	Wheat rolls, brown	4	35	0.01	0.1
A.01.04.001.014	Wheat rolls, brown and oil seeds	4	35	0.01	0.1
A.01.04.001.015	Wheat rolls, with oil seeds	4	35	0.01	0.1
A.01.04.001.017	Wheat toast bread, brown	4	35	0.01	0.1
A.01.04.002	Rye bread and rolls	3	35	0.01	0.1
A.01.04.003	Mixed wheat/rye bread and rolls	3	35	0.01	0.1
A.01.04.004	Multigrain bread and rolls	3	35	0.01	0.1
A.01.04.006.004	Muesli bread	4	35	0.01	0.1
A.01.04.006.005	Oat bread	4	35	0.01	0.1
A.01.06.001	Cereal flakes	3	35	0.04	0.03
A.01.06.002	Muesli	3	35	0.001	0.03
A.01.06.003	Cereal bars	3	35	0.001	0.01
A.01.07.001.020	Fruit cake	4	35	0.01	0.25
A.01.07.001.024	Gingerbread	4	35	0.1	1
A.01.07.001.044	Lebkuchen	4	35	0.1	1
A.01.07.002.008	Speculaas	4	35	0.1	1
A.10.04.001	Candies, with sugar	3	35	0.001	0.01
A.10.04.011	Liquorice candies	3	35	0.001	0.13
A.10.04.012	Gum drops	3	35	0.001	0.01
A.10.04.013	Jelly candies	3	35	0.001	0.01
A.10.06.001	Molasses	4	35	1	1
A.10.06.005	Sugar beet syrup	4	35	1	1
A.10.06.006	Treacle	4	35	1	1
A.16.05.001	Mustard, sweet	3	35	0.035	1
A.16.05.007	Barbecue sauce	3	35	0.05	1
A.16.05.015	Mixed condiment	3	35	0.05	0.25
A.16.08.002	Brown sauce	3	35	0.05	1
A.19.02.002	Rice and meat meal	3	35	0.01	0.1
A.19.02.003	Rice, meat and vegetables meal	3	35	0.01	0.1

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Converting unrefined sugar product* to sugar beet or cane)	f2 (Average fraction of unrefined sugar product* in respective FoodEx category)	f3 (Percentage of FoodEx category containing unrefined sugar product*)
A.19.03.002	Potatoes and meat meal	3	35	0.01	0.1
A.19.03.003	Potatoes, meat and vegetables meal	3	35	0.01	0.1
A.19.04.001	Beans and meat meal	3	35	0.01	0.1
A.19.04.003	Beans, meat and vegetables meal	3	35	0.01	0.1
A.19.05.004	Meat stew	3	35	0.01	0.1
A.20.02.001	Ice cream, milk-based	3	35	0.01	1

*: Beet molasses and cane syrups, excluding brown sugar.

3.14. Hydrolysis of whey proteins for use in infant formula, follow-on formulae and food for special medical purposes

This process is included in the 'EC working document on food processes in which food enzymes are used' as part of protein processing, however, because the intended use concerns vulnerable population groups, a separate process for this intended use was established. It deals exclusively with enzymes that are used to produce whey protein hydrolysates for use in infant formula (IF), follow-on formulae (FOF) and food for special medical purposes (FSMP).

In 2014,¹⁸ the EFSA Scientific Committee (SC) prepared a guidance for the risk assessment of substances in food intended for infants below 16 weeks of age. This guidance was followed for the assessment of exposure to the food enzymes used in the hydrolysis of whey proteins. The Scientific Committee derived a formula consumption value of 260 mL/kg body weight (bw) per day, derived from 95th percentile consumption during the period of 14–27 days of life. This time reflects the highest relative consumption on a body weight basis and also covers the potential high consumption rates of preterm infants on enteral (formula) feeding.

The value of 260 mL/kg bw per day therefore is used to calculate exposure to food enzyme-TOS through consumption IF/FOF or FSMP, respectively.

Based on maximum energy and maximum protein content provided for IF and FOF in Regulation (EU) 2016/127, the maximum protein content per 100 ml prepared formula equates to 1.96g protein/100 ml formula. The recommended consumption value by the Scientific Committee of 260 ml/kg bw per day therefore may contain up to 5.1 g of protein.

The maximum use level expressed as mg TOS/g protein therefore allows for calculation of the exposure of an infant from consumption of 260ml formula/kg bw per day (containing 5.1 g protein).

3.15. Degumming of fats and oils

This process has been adapted from the 'EC working document on food processes in which food enzymes are used' as the following⁴:

Crude oil extracted from different plant sources (e.g. oilseeds, fruit pulps) is the principal raw material. Water refining, usually called degumming, is the treatment of crude oils and fats with a small amount of water repeatedly to remove water-soluble impurities, followed by centrifugal separation to produce refined oils. The process is applied to many oils that contain phospholipids in significant amounts.

Vegetable oils derived through degumming are excluded from dietary exposure calculation, as the degummed oil is further washed with water and centrifuged to remove the water/gum phase. The

¹⁸ Available at <https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2017.4849>

enzyme is retained in the water/gum phase. Repeated refining to remove impurities after degumming, filtration and purification steps also removes any residual TOS to a negligible amount.

This assumption was supported by information submitted by AMFEP together with the Federation representing the European Vegetable Oil and Protein Meal Industry in Europe,¹⁹ which included a description of the main steps of the refined vegetable oil production through enzymatic degumming in relation to the addition and inactivation/removal of food enzymes, and analytical data on the intermediate products and final ingredients. When using the total protein and true protein-specific nitrogen as the proxy to consider the residual food enzyme-TOS, it is estimated that > 99% of enzymes added to the raw material are removed during the process. The Panel considered the evidence as sufficient to conclude that residual amounts of TOS are removed by the purification steps applied during the production of vegetable fats and oils (by > 99%), i.e. repeated washing and centrifugation.

3.16. Modification of fats and oils by interesterification

This process has been adapted from the 'EC working document on food processes in which food enzymes are used' as the following⁴:

This food manufacturing process covers any modification of oils and fats designed to improve functionality through interesterification.

Concerning the interesterification of fats and oils, AMFEP, in October 2017, provided technical information, which indicated that (i) immobilised lipases are used for enzymatic interesterification of oil/fat, (ii) interesterification is operated as a 'continuous' process and (iii) 1 kg enzyme TOS is used for the production of at least 20–100 tons refined oil. Assuming that all TOS would leach into the final oil product, AMFEP estimated that 1 kg enzyme TOS/100,000 kg oil would correspond to 0.001% TOS in final oil products.²⁰

This information was not considered sufficient to waive the need for calculating exposure. In particular, since different approaches to immobilising food enzymes are in use, and are often specific to the individual application, the Panel decided to request the relevant technical information and/or experimental data on a case-by-case basis.

In February 2020, EFSA launched a call-for-data on interesterified fats. The input data contained a list of FoodEx categories and respective technical conversion factors. Due to the difficulty of distinguishing enzymatically interesterified fats from chemically modified vegetable fats, EFSA decided to use all vegetable fats (except fats and oils consumed as such or used as ingredient in chocolate²¹) as a proxy for enzymatically interesterified fats. Consequently, the FoodEx categories cover foods that contain processed vegetable fats, such as margarine and shortening.

Following this call,²² a response was received from the EU vegetable oil and protein meal industry association (FEDIOL) with input from FoodDrinkEurope, CAOBISCO, Federation of Associations and Enterprises of Industrial Culinary Product Producers in Europe, European Snack Association, European Ice Cream Association, European Margarine Association. It is clarified that butter biscuits contain only butter as the fat component. These associations also specified the amount of enzymatically interesterified fats in margarine.²³

The following input data were used to estimate dietary exposure to food enzyme-TOS in foods relevant to this intended use.

¹⁹ Information on 'Transfer of enzymes into food, for fat and oil processing'. October 2017 and February 2019.

²⁰ AMFEP answer to EFSA's request for additional information on the transfer of enzymes into food, for fat and oil processing. October 2017.

²¹ Directive 2000/36/EC of the European Parliament and of the Council of 23 June 2000 relating to cocoa and chocolate products intended for human consumption (OJ L 197, 3.8.2000, p.19) specifies that vegetable fats used in chocolate are to be obtained only by the processes of refining and/or fractionation, which excludes enzymatic modification of the triglyceride structure

²² <https://www.efsa.europa.eu/en/consultations/call/call-input-data-exposure-assessment-food-enzymes-5th-call>

²³ Feedback regarding FEDIOL input into the 5th EFSA call for input data for the Exposure Assessment of Food Enzymes related to fats and oils processing for interesterification. October 2020 & May 2021.

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Conversion from IE fats to vegetable oils)	f2 (Average fraction of vegetable fats in respective FoodEx category)
A.01.04	Bread and rolls (unspecified)	4	1	0.03
A.01.04.001	Wheat bread and rolls	3	1	0.03
A.01.04.002	Rye bread and rolls	3	1	0.03
A.01.04.003	Mixed wheat and rye bread and rolls	3	1	0.03
A.01.04.004	Multigrain bread and rolls	3	1	0.03
A.01.04.005	Unleavened bread, crisp bread and rusk (unspecified)	4	1	0.07
A.01.04.005.005	Rusk, light	4	1	0.07
A.01.04.005.006	Rusk, wholemeal	4	1	0.07
A.01.04.005.009	Tortilla	4	1	0.07
A.01.04.006	Other bread	3	1	0.03
A.01.04.007	Bread products	3	1	0.03
A.01.06.002.001	Muesli bars	4	1	0.13
A.01.06.003	Cereal bars	3	1	0.13
A.01.07	Fine bakery wares (unspecified)	4	1	0.10
A.01.07.001	Pastries and cakes (unspecified)	4	1	0.10
A.01.07.001.001	Beignets	4	1	0.14
A.01.07.001.002	Buns	4	1	0.29
A.01.07.001.003	Cake from batter	4	1	0.25
A.01.07.001.004	Cheese cream cake	4	1	0.04
A.01.07.001.005	Cheese cream sponge cake	4	1	0.15
A.01.07.001.006	Chocolate cake	4	1	0.09
A.01.07.001.007	Chocolate cake with fruits	4	1	0.06
A.01.07.001.009	Cream cheese cake	4	1	0.02
A.01.07.001.010	Cream custard cake	4	1	0.19
A.01.07.001.011	Cream custard sponge cake	4	1	0.01
A.01.07.001.012	Croissant	4	1	0.19
A.01.07.001.013	Croissant, filled with chocolate	4	1	0.14
A.01.07.001.014	Croissant, filled with cream	4	1	0.14
A.01.07.001.015	Croissant, filled with jam	4	1	0.14
A.01.07.001.016	Croquembouche	4	1	0.06
A.01.07.001.017	Doughnuts	4	1	0.06
A.01.07.001.018	Éclair	4	1	0.11
A.01.07.001.020	Fruit cake	4	1	0.14
A.01.07.001.021	Fruit pie	4	1	0.17
A.01.07.001.022	Cheese pie	4	1	0.18
A.01.07.001.023	Fruit tart	4	1	0.10
A.01.07.001.024	Gingerbread	4	1	0.19
A.01.07.001.025	Gougere	4	1	0.12
A.01.07.001.026	Kringles	4	1	0.18
A.01.07.001.027	Nut cream cake	4	1	0.17
A.01.07.001.028	Pancakes	4	1	0.05
A.01.07.001.029	Profiterole	4	1	0.09
A.01.07.001.030	Pyramid cake	4	1	0.15
A.01.07.001.031	Rhubarb flan	4	1	0.08
A.01.07.001.032	Scone	4	1	0.18

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Conversion from IE fats to vegetable oils)	f2 (Average fraction of vegetable fats in respective FoodEx category)
A.01.07.001.033	Sponge dough	4	1	0.25
A.01.07.001.034	Sponge cake	4	1	0.25
A.01.07.001.035	Sponge cake roll	4	1	0.18
A.01.07.001.037	Waffles	4	1	0.11
A.01.07.001.038	Apple strudel	4	1	0.14
A.01.07.001.039	Cream-cheese strudel	4	1	0.17
A.01.07.001.040	Cheese pastry goods from puff pastry	4	1	0.19
A.01.07.001.041	Croissant from puff pastry	4	1	0.19
A.01.07.001.042	Brioche	4	1	0.12
A.01.07.001.044	Lebkuchen	4	1	0.19
A.01.07.001.045	Dumpling	4	1	0.05
A.01.07.001.046	Cake marbled, with chocolate	4	1	0.18
A.01.07.001.047	Marzipan pie	4	1	0.17
A.01.07.001.048	Baklava	4	1	0.13
A.01.07.002	Biscuits (cookies) (unspecified)	4	1	0.20
A.01.07.002.001	Biscuits, sweet, plain	4	1	0.20
A.01.07.002.002	Biscuits, chocolate filling	4	1	0.12
A.01.07.002.003	Biscuits, cream filling	4	1	0.09
A.01.07.002.004	Biscuits, fruit filling	4	1	0.18
A.01.07.002.005	Biscuits, vanilla filling	4	1	0.09
A.01.07.002.007	Biscuit, iced	4	1	0.17
A.01.07.002.008	Speculaas	4	1	0.20
A.01.07.002.009	Biscuits, sweet, wheat wholemeal	4	1	0.21
A.01.07.002.010	Biscuits, oat meal	4	1	0.21
A.01.07.002.011	Biscuits, spelt meal	4	1	0.21
A.01.07.002.012	Biscuits, salty	4	1	0.23
A.01.07.002.013	Biscuits, salty, with cheese	4	1	0.21
A.01.07.002.014	Sticks, salty	4	1	0.07
A.08.09	Milk and milk product imitates (unspecified)	4	1	0.01
A.08.09.002	Imitation cream	4	1	0.29
A.10.03.004	Chocolate, cream	3	1	0.08
A.10.03.006	Chocolate coated confectionery	3	1	0.09
A.10.03.007	Filled chocolate	3	1	0.08
A.10.03.010	Pralines	4	1	0.10
A.10.03.014	Chocolate substitutes	4	1	0.56
A.10.04	Confectionery (non-chocolate)	4	1	0.04
A.10.04.004	Caramel, hard	4	1	0.04
A.10.04.006	Toffee	4	1	0.05
A.10.04.007	Fudge	4	1	0.05
A.10.04.012	Gum drops	4	1	0.06
A.10.04.013	Jelly candies	4	1	0.06
A.10.04.014	Nougat	4	1	0.02
A.10.04.015	Halva	3	1	0.02
A.10.05.003	Fudge sauce	4	1	0.19
A.11.03.001	Peanuts butter	4	1	0.11

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Conversion from IE fats to vegetable oils)	f2 (Average fraction of vegetable fats in respective FoodEx category)
A.11.05	Fats of mixed origin	4	1	0.83
A.11.06	Margarine and similar products	2	1	0.06
A.16.04.008	Stock cubes (bouillon cube)	4	1	0.17
A.16.08.001	White sauce	3	1	0.38
A.16.08.010	Vegetable sauce	3	1	0.06
A.19.01.001	Sandwich and sandwich-like meal	3	1	0.02
A.19.01.002	Pizza and pizza-like pies	3	1	0.01
A.19.03.002	Potatoes and meat meal	3	1	0.01
A.19.10	Ready to eat soups	2	1	0.01
A.20.02	Ices and desserts (unspecified)	4	1	0.02
A.20.02.001	Ice cream, milk-based	3	1	0.005
A.20.02.002	Ice cream, not milk-based	3	1	0.005
A.20.02.003	Starchy pudding	3	1	0.06

3.17. Treatment of plant and algae for edible oil production

This process is not listed in the 'EC working document on food processes in which food enzymes are used', however, applications for this intended use were received by EFSA. On the basis of similarity with the fruit and vegetable processing described in the 'EC working document on food processes in which food enzymes are used', a definition is given as follows⁴:

This food process relies on oil-rich plant parts (pulp and seeds) or microalgae as the raw material and leads to the production of plant or algal oils for human consumption.

This process allows the aqueous extraction of crude vegetable oils. The food enzyme-TOS is predominantly separated from the oil phase and stays within the aqueous phase. Residual amounts of TOS may remain in the crude oils. For crude oils that are degummed and further refined, these steps are expected to remove any residual TOS in edible vegetable oils to a negligible amount.

This assumption was supported by information submitted by AMFEP,²⁴ which included (i) a process diagram showing steps from treating fruit and vegetable material with cell-wall degrading enzymes to the first extraction of crude oils; (ii) a process diagram showing steps for treating microalgae with cell-wall degrading enzymes for the extraction of crude oils; (iii) proximate analysis on the intermediate products and final algal oils; (iv) a theoretical calculation. Using the hydrophilic properties of enzymes and the residual moisture of algal oil as the proxy, it is estimated that the amount of TOS in refined edible oils would not exceed 0.0001%.

The Panel considered the evidence provided by AMFEP as sufficient to support the exclusion of refined final oil products derived from enzymatically treated plants and algae from dietary exposure calculation. However, for non-refined oils intended for human consumption, minor amounts of TOS are expected to remain in the final oil. To exclude such non-refined edible oils from exposure estimation, the applicant should provide analytical data to substantiate TOS removal of at least 99%.

3.18. Lactose hydrolysis in dairy processing

This process has been adapted from the 'EC working document on food processes in which food enzymes are used' as follows⁴:

This food process relies on milk, components of milk and processed dairy products as the principle raw material and leads to the production of dairy products with reduced lactose content.

²⁴ Information on 'Transfer of enzymes into food, as consumed in fruit and vegetable processing for vegetable oil production'. February and July 2021.

The Comprehensive Food Consumption Database currently does not provide sufficient details to identify consumers for dairy products with reduced lactose content. Nowadays, lactose-reduced products are widely available in the market. The selection of food categories was therefore based on the assumption that consumption of lactose-reduced products is similar to dairy products in general. An exception, however, was made for cheese and yoghurts, which are often naturally lactose-reduced or even lactose-free. Therefore, factor f3 has been assigned to these groups to reflect the proportion of foods within these two food categories that are likely to have been treated with a food enzyme to degrade lactose.

Feedback was also sought on which type of food categories containing whey produced from lactose-reduced milk and lactose-reduced milk powder, and in particular to specify whether lactose-reduced whey and/or lactose-reduced milk is used in the production of infant formulae and follow-on formulae.

An open call-for-data is ongoing.²⁵

3.19. Cheese production in dairy processing

This process has been adapted from the 'EC working document on food processes in which food enzymes are used' as follows⁴:

This food process relies on milk as the principle raw material and leads to the production of cheese with whey as a by-product.

This call considers milk coagulation by enzymes and takes account of differential partition of enzymes in curd and whey. After the milk coagulation, the cheese curd is separated from the whey. Retention factors were provided by the Specialised Nutrition Europe to account for the partition of enzyme residues after the separation: 20% in curd and 80% in whey.^{26,27}

Cheeses and food products that contain cheeses can be clearly identified in the EFSA Raw RPC model. However, this is not the case for food products containing whey as an ingredient. The selection of these food categories was aided by information available in recipes and in databases such as Mintel's Global New Products Database. Feedback is sought, therefore, particularly on what type of food categories containing whey as an ingredient.

An open call-for-data is ongoing.²⁸

3.20. Fruit and vegetable processing for juice production

This process has been adapted from the 'EC working document on food processes in which food enzymes are used' as follows⁴:

This food process relies on fruit and vegetable raw materials and leads to the production of juices.

Following the open call for fruit and vegetable juice production,²⁹ feedback was received from the European Fruit Juice Association (AIJN). The following input data were used to estimate dietary exposure to food enzyme-TOS in foods relevant to this intended use.

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Converting juice ingredients to fruit or vegetable)	f2 (Average fraction of juice ingredients in respective FoodEx category)
A.01.06.003.004	Cereal bar, with no added sugar	4	4.50	0.02
A.01.07.001.023	Fruit tart	4	1.80	0.07
I.05.08.003.001	Fruit spreads, Sirop de Liège	4	3.90	0.55

²⁵ <https://www.efsa.europa.eu/en/call/call-input-data-exposure-assessment-food-enzymes-7th-call>

²⁶ Feedback from the SNE to the call for input data for the Exposure Assessment of Food Enzymes related to Protein components in infant formulae and follow-on formulae. April 2019.

²⁷ <https://www.efsa.europa.eu/en/consultations/call/call-input-data-exposure-assessment-food-enzymes-3rd-call>

²⁸ <https://www.efsa.europa.eu/en/call/call-input-data-exposure-assessment-food-enzymes-8th-call>

²⁹ <https://www.efsa.europa.eu/en/call/call-input-data-exposure-assessment-food-enzymes-9th-call>

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Converting juice ingredients to fruit or vegetable)	f2 (Average fraction of juice ingredients in respective FoodEx category)
I.05.08.003.004	Fruit spreads, Jelly	4	1.30	0.40
A.05.09.006.001	Canned fruit, Mandarin (<i>Citrus reticulata</i>)	4	2.60	0.01
A.05.09.006.002	Canned fruit, Apple (<i>Malus domestica</i>)	4	2.60	0.01
A.05.09.006.003	Canned fruit, Pear (<i>Pyrus communis</i>)	4	2.60	0.01
A.05.09.006.004	Canned fruit, Apricot (<i>Prunus armeniaca</i>)	4	3.90	0.10
A.05.09.006.005	Canned fruit, Plum (<i>Prunus domestica</i>)	4	2.60	0.01
A.05.09.006.006	Canned fruit, Sweet cherry (<i>Prunus avium</i>)	4	2.60	0.01
A.05.09.006.007	Canned fruit, Sour cherry (<i>Prunus cerasus</i>)	4	2.60	0.01
A.05.09.006.008	Canned fruit, Peach (<i>Prunus persica</i>)	4	3.90	0.10
A.05.09.006.010	Canned fruit, Cranberry (<i>Vaccinium macrocarpon</i>)	4	2.60	0.01
A.05.09.006.011	Canned fruit, Pineapple (<i>Ananas comosus</i>)	4	5.00	0.38
A.05.09.006.012	Canned fruit, Mixed fruit	4	2.60	0.01
A.05.09.009	Fruit in vinegar, oil, or brine	3	3.90	0.83
I.07.02.004.003	Fish paste, Salmon	4	2.60	0.01
I.07.02.005.002	Fish pâté, Salmon	4	2.60	0.03
A.08.02.001.001	Fruit-flavoured milk	4	1.30	0.04
A.08.02.002.002	Fruit milkshake	4	1.00	0.20
I.10.03.006.009	Chocolate coated biscuit, fruit filling	4	3.90	0.01
I.10.03.007.004	Filled chocolate, flavoured cream	4	3.90	0.01
A.10.04.014	Nougat	3	8.30	0.01
I.10.05.001.002	Fruit sauce, Lemon	4	8.30	0.02
I.10.05.001.003	Fruit sauce, Raspberry	4	3.90	0.02
A.10.05.004	Alcoholic sweet sauce	4	2.60	0.05
A.12.01	Fruit juice	4	1.30	1.00
A.12.01.001	Juice, Apple	4	1.31	1.00
A.12.01.002	Juice, Orange	4	1.80	1.00
A.12.01.003	Juice, Grapefruit	4	2.10	1.00
A.12.01.004	Juice, Pineapple	4	5.00	1.00
A.12.01.005	Juice, Mango	4	10.00	1.00
A.12.01.006	Juice, Grape	4	1.30	1.00
A.12.01.007	Juice, Cranberry	4	1.46	1.00
A.12.01.008	Juice, Pomegranate	4	1.30	1.00
A.12.01.009	Juice, Peach	4	1.49	1.00
A.12.01.010	Juice, Lemon	4	2.60	1.00
A.12.01.011	Juice, Lime	4	2.60	1.00
A.12.01.012	Juice, Pear	4	1.30	1.00
A.12.01.013	Juice, Apricot	4	1.49	1.00
A.12.01.014	Juice, Nectarine	4	1.30	1.00
A.12.01.015	Juice, Blackberry	4	1.30	1.00

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Converting juice ingredients to fruit or vegetable)	f2 (Average fraction of juice ingredients in respective FoodEx category)
A.12.01.016	Juice, Blackcurrant	4	1.30	1.00
A.12.01.017	Juice, Prune	4	1.30	1.00
A.12.01.018	Juice, Redcurrant	4	1.30	1.00
A.12.01.019	Juice, Elderberry	4	1.49	1.00
A.12.01.020	Juice, Passion fruit	4	1.30	1.00
A.12.01.021	Juice, Guava	4	1.30	1.00
I.12.01.022	Juice, Raspberry	4	1.28	1.00
I.12.01.023	Juice, Cherry	4	1.30	1.00
I.12.01.024	Juice, Strawberry	4	1.28	1.00
I.12.01.025	Juice, Mandarin	4	2.20	1.00
I.12.01.026	Juice, kiwi	4	1.30	1.00
I.12.01.027	Juice, Blueberry	4	1.30	1.00
A.12.02	Concentrated fruit juice (unspecified)	4	3.90	1.00
A.12.02.001	Juice concentrate, Strawberries	4	3.90	1.00
A.12.02.002	Juice concentrate, Raspberries	4	3.90	1.00
A.12.02.003	Juice concentrate, Blackberries	4	3.90	1.00
A.12.02.004	Juice concentrate, Currants (red)	4	3.90	1.00
A.12.02.005	Juice concentrate, Currants (black)	4	3.90	1.00
A.12.02.006	Juice concentrate, Gooseberries	4	3.90	1.00
A.12.02.007	Juice concentrate, Cranberries	4	3.90	1.00
A.12.02.008	Juice concentrate, Blueberries	4	3.90	1.00
A.12.02.009	Juice concentrate, Apricots	4	3.90	1.00
A.12.02.010	Juice concentrate, Plums	4	3.90	1.00
A.12.02.011	Juice concentrate, Peaches	4	3.90	1.00
A.12.02.012	Juice concentrate, Sweet cherry	4	3.90	1.00
A.12.02.013	Juice concentrate, Oranges	4	10.00	1.00
A.12.02.014	Juice concentrate, Mandarins	4	6.60	1.00
I.12.02.015	Juice concentrate, Rosehip	4	3.90	1.00
I.12.02.016	Juice concentrate, Apple	4	4.50	1.00
I.12.02.017	Juice concentrate, Lemon	4	8.30	1.00
I.12.02.018	Juice concentrate, Pear	4	3.90	1.00
I.12.02.019	Juice concentrate, Quince	4	3.90	1.00
I.12.02.020	Juice concentrate, Lime	4	8.30	1.00
I.12.02.021	Juice concentrate, Passion fruit	4	3.90	1.00
I.12.02.022	Juice concentrate, Mango	4	30.00	1.00
I.12.02.023	Juice concentrate, Papaya	4	3.90	1.00
I.12.02.024	Juice concentrate, Mixed fruit	4	3.90	1.00
A.12.03	Fruit nectar (unspecified)	4	1.30	0.25
A.12.03.001	Nectar, Mango	4	10.00	0.25
A.12.03.002	Nectar, Peach	4	1.30	0.50
A.12.03.003	Nectar, Pear	4	1.30	0.50
A.12.03.004	Nectar, Orange	4	1.80	0.50
A.12.03.005	Nectar, Pineapple	4	5.00	0.50
A.12.03.006	Nectar, Banana	4	1.30	0.25
A.12.03.007	Nectar, Apple	4	1.50	0.50

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Converting juice ingredients to fruit or vegetable)	f2 (Average fraction of juice ingredients in respective FoodEx category)
I.12.03.008	Nectar, Apricot	4	1.30	0.40
I.12.03.009	Nectar, Blackcurrant	4	1.30	0.25
I.12.03.010	Nectar, Cherry	4	1.30	0.40
I.12.03.011	Nectar, Cranberry	4	1.30	0.30
I.12.03.012	Nectar, Grape	4	1.30	0.25
I.12.03.013	Nectar, Lemon	4	2.60	0.25
I.12.03.014	Nectar, Redcurrant	4	1.30	0.25
I.12.03.015	Nectar, Mixed fruit	4	1.30	0.25
I.12.03.015.001	Nectar, Berries	4	1.30	0.25
I.12.03.015.002	Nectar, Carrot–orange–lemon	4	1.30	0.25
I.12.03.015.003	Nectar, Apricot–orange	4	1.30	0.25
I.12.03.016	Nectar, other	3	1.30	0.25
A.12.04	Mixed fruit juice	2	1.30	1.00
A.12.05	Dehydrated/powdered fruit juice	2	10.00	1.00
A.12.06	Vegetable juice	2	1.30	1.00
A.12.07	Mixed vegetable juice	2	1.30	1.00
A.12.08	Mixed fruit and vegetable juice	2	1.30	1.00
A.13.01.001.001	Fruit soft drink, Currant red	4	1.30	0.10
A.13.01.001.002	Fruit soft drink, Currant white	4	1.30	0.10
A.13.01.001.003	Fruit soft drink, Gooseberry	4	1.50	0.10
A.13.01.001.004	Fruit soft drink, Grape red	4	1.30	0.10
A.13.01.001.005	Fruit soft drink, Grape white	4	1.30	0.10
A.13.01.001.006	Fruit soft drink, Grapefruit	4	2.10	0.10
A.13.01.001.007	Fruit soft drink, Mango	4	10.00	0.10
A.13.01.001.010	Fruit soft drink, Orange	4	1.80	0.10
A.13.01.001.011	Fruit soft drink, Papaya	4	1.30	0.10
A.13.01.001.012	Fruit soft drink, Peach	4	1.30	0.10
A.13.01.001.013	Fruit soft drink, Pear	4	1.30	0.10
A.13.01.001.014	Fruit soft drink, Pineapple	4	5.00	0.10
A.13.01.001.015	Fruit soft drink, Plum/prune	4	1.30	0.10
A.13.01.001.016	Fruit soft drink, Pomegranate	4	1.30	0.10
A.13.01.001.017	Fruit soft drink, Raspberry	4	1.30	0.10
A.13.01.001.020	Fruit soft drink, mixed fruit	4	1.30	0.10
A.13.01.001.021	Fruit soft drink, mixed fruit, with sweetener	4	1.30	0.10
I.13.01.001.022	Fruit soft drink, Apple	4	1.50	0.10
I.13.01.001.023	Fruit soft drink, Lemon	4	2.60	0.10
I.13.01.001.024	Fruit soft drink, Blackcurrant	4	1.30	0.10
I.13.01.001.025	Cordial, Mixed fruit	4	1.30	0.10
A.13.01.002	Soft drink, flavoured	4	1.30	0.01
A.13.01.002.001	Soft drink with bitter principle	4	2.60	0.01
A.13.01.002.002	Soft drink, apple flavour	4	1.50	0.01
A.13.01.002.003	Soft drink, apricot flavour	4	1.30	0.01
A.13.01.002.004	Soft drink, banana flavour	4	1.30	0.01
A.13.01.002.005	Soft drink, cherry flavour	4	1.30	0.01
A.13.01.002.006	Soft drink, flavoured with herbs	4	1.30	0.01

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (Converting juice ingredients to fruit or vegetable)	f2 (Average fraction of juice ingredients in respective FoodEx category)
A.13.01.002.007	Soft drink, grapefruit flavour	4	2.10	0.01
A.13.01.002.008	Soft drink, lemon flavour	4	2.60	0.01
A.13.01.002.009	Soft drink, lime flavour	4	2.60	0.01
A.13.01.002.010	Soft drink, mixed flavours	4	1.30	0.01
A.13.01.002.011	Soft drink, orange flavour	4	1.80	0.01
A.13.01.002.012	Soft drink, pear flavour	4	1.30	0.01
A.13.01.002.013	Soft drink, pineapple flavour	4	5.00	0.01
A.13.01.002.014	Soft drink, raspberry flavour	4	1.30	0.01
A.13.01.002.015	Soft drink, mango flavour	4	10.00	0.01
A.13.01.007	Cola Mix	4	1.30	0.02
I.14.01.006	Beer with limonade 1/1	3	2.60	0.05
I.14.07.001.002	Pina colada	4	5.00	0.59
A.14.07.002	Punch	3	1.30	0.03
A.14.07.003	Alcopop	3	1.30	0.03
A.16.05.013	Salsa	3	1.30	0.03
A.16.05.014	Tartar sauce	3	8.30	0.01
A.16.06	Dressing	2	8.30	0.01
A.16.07.006	Piccalilli	3	8.30	0.05
I.16.08.003.009	Cream sauce, tzatziki	4	8.30	0.01
A.16.08.004	Butter sauce	3	8.30	0.01
I.16.08.005.001	Sauce béarnaise	4	8.30	0.01
I.16.08.005.002	Sauce hollandaise	4	8.30	0.01
I.16.08.006.001	Aioli/Garlic sauce	4	8.30	0.01
I.16.08.009.003	Tuna sauce	4	8.30	0.01
I.16.08.010.009	Tomato sauce	4	8.30	0.01
I.16.08.010.010	Guacamole sauce	4	8.30	0.01
A.17.08.001	Fruit juice for infants and young children	3	1.30	1.00
A.17.08.002	Fruit nectar for infants and young children	3	1.30	0.25
A.17.08.004	Tee and juice mixture for infants and young children	3	1.30	0.50
A.18.04.005	Fruit-based beverages for diabetics	3	1.30	1.00
A.19.06.002	Fish and rice meal	3	2.60	0.01
I.19.06.003.001	Fish and vegetable gratin	4	2.60	0.01
I.19.06.006	Salmon en crouste	3	2.60	0.01
I.19.06.007	Fish gratin	3	2.60	0.01
A.19.10.001	Vegetable/herb soup	3	3.90	0.01
A.19.10.005	Fish soup	3	2.60	0.01
I.19.10.011	Vegetable broth	3	3.90	0.01
A.19.11.009	Prepared fish salad	3	2.60	0.01
A.20.02.005	Sorbet	3	2.60	0.34
I.20.02.006.001	Jelly dessert	4	1.30	0.02
I.20.02.006.002	Rote gruetze	4	2.60	0.09
A.20.02.007	Granita	3	1.30	0.41

3.21. Fruit and vegetable processing for products other than juices

This process has been adapted from the 'EC working document on food processes in which food enzymes are used' as follows⁴:

This food process relies on fruit and vegetable raw materials and leads to the production of products such as but not limited to purée, compotes, jams, jellies and marmalades, canned fruits and vegetables, and other fruit and vegetable preparations.

An open call-for-data is ongoing.³⁰

3.22. Alcoholic beverages derived from fruit other than grapes

This process is defined according to the 'EC working document on food processes in which food enzymes are used' as the following⁴:

*Fruit derived alcoholic beverages processing relies on fruit raw materials other than grapes and leads to the production of an alcoholic beverage obtained by the complete or partial fermentation of the juice, the pulp of fresh fruits, or reconstituted concentrated fruit juice.*³¹

An open call-for-data is ongoing.³⁰

3.23. Processing of tea, herbal and fruit infusions

This process is described in the 'EC working document on food processes in which food enzymes are used' as follows⁴:

*Tea processing relies on leaves and tender shoots of varieties of the species *Camellia sinensis* (L.) O. Kuntze as the raw material for manufacture of leaf tea and aqueous extracts of tea (including dried extracts).*

*Herbal and fruit infusions processing rely on plants or parts of plants that do not originate from the tea plant (*Camellia sinensis* (L.) O. Kuntze) as the raw material for manufacture of herbal and fruit infusions including dried extracts.*

An open call-for-data is ongoing.³²

3.24. Fermented dairy products

This process has been adapted from the 'EC working document on food processes in which food enzymes are used' as follows⁴:

This food process relies on milk as the principle raw material and leads to the production of fermented products such as, but not limited to, yoghurt, sour cream and buttermilk.

An open call-for-data is ongoing.³³

3.25. Manufacture of enzyme-modified dairy ingredients

This process has been adapted from the 'EC working document on food processes in which food enzymes are used' as follows⁴:

This food process relies on dairy products to which enzymes are added with the intention of modifying sensory properties.

This process considers the production of Enzyme Modified Dairy Ingredients (EMDI). EMDI are flavoured ingredients derived by enzymatic processes from dairy ingredients such as cheese, butter, cream. The selection of food groups that contain EMDI as an ingredient could not be clearly identified in the EFSA RPC model. Therefore, the selection of these food categories was aided by information

³⁰ <https://www.efsa.europa.eu/en/call/call-input-data-exposure-assessment-food-enzymes-10th-call>

³¹ The term 'fruit derived alcoholic beverages' is defined in the European Cider and Fruit Wine Association (AICV) voluntary ingredient listing & nutrition information: production process for cider and fruit wine (available online: https://ec.europa.eu/food/system/files/2018-03/fs_labelling-nutrition_legis_alcohol-self-regulatory-proposal_cider_en.pdf).

³² <https://www.efsa.europa.eu/en/call/call-input-data-exposure-assessment-food-enzymes-11th-call>

³³ <https://www.efsa.europa.eu/en/call/call-input-data-exposure-assessment-food-enzymes-12th-call>

from literatures and in the GNPD database. The keywords 'flavour', 'natural flavour' and their variants were used in the search.

An open call-for-data is ongoing.³⁴

References

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Abbreviations

AICV	European Cider and Fruit Wine Association
AIJN	European Fruit Juice Association
AMFEP	European Association of Manufacturers and Formulators of Enzyme Products
ANS	EFSA Panel Food Additives and Nutrient Sources Added to Food
CAOBISCO	Association of Chocolate, Biscuits and Confectionery Industries of Europe
CEF	EFSA Panel on Food Contact Materials, Enzymes, Flavourings and Processing Aids
CEFS	European Association of Sugar Manufacturers
CEP	EFSA Panel on Food Contact Materials, Enzymes and Processing Aids
EMDI	Enzyme Modified Dairy Ingredients
FAIM	Food Additive Intake Model
FAO	Food and Agricultural Organization of the United Nations
FEDIOL	EU vegetable oil and protein meal industry association
FEIM	Food Enzyme Intake Models
FOF	Follow-on Formulae
FSMP	Food for Special Medical Purposes
GNPD	Global New Products Database
IF	Infant Formula
RPC	Raw primary commodity
SC	EFSA Scientific Committee
TOS	Total organic solids

³⁴ <https://www.efsa.europa.eu/en/call/call-input-data-exposure-assessment-food-enzymes-13th-call>