

Statistical analysis of chlorate occurrence data in food

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1. Introduction

1.1. Background (provided by the requestor)

In accordance with Article 29 (1) (a) of Regulation (EC) No 178/2002, the European Commission asked EFSA in 2014 for a scientific opinion on the risks to human health related to the presence of chlorate in food from all sources, taking also into account its presence in drinking water¹.

EFSA found that current levels of chlorate in foods and in drinking water were too high and could negatively impact iodine uptake especially among infants and children and published its scientific opinion on 24 June 2015².

Chlorate originates from chlorine disinfectants widely and legally used in water treatment and food processing, drinking water being by far the main contributor. Chlorate is no longer approved as a pesticide; therefore the default maximum residue level (MRL) of 0.01 mg/kg applies. However, the levels found in foods are often above this MRL.

A general multi-disciplinary action plan for reducing the dietary exposure to chlorate and for resolving the systemic non-compliance with the pesticides MRLs was supported by the meeting of the heads of national food safety agencies on 23 May 2017 in Oslo. As part of this action plan, maximum residue levels (MRLs) for chlorate should be set in regular food at levels based on occurrence data.

In the context of its opinion, EFSA provided a statistical analysis of chlorate occurrence levels using a database of analytical results of 8.028 samples of food and drinking water collected by Member States between 2011 and 2014. After that date, Member States continued to collect food samples, to analyse their chlorate content and to forward the results of these laboratory analysis to EFSA.

In the meantime, food manufacturers started to optimise their manufacturing processes to lower chlorate residue level in foods. Good hygiene practices regarding the use of chlorinated disinfectant, including advice for the storage of such disinfectant solutions, were provided by the Commission in a revised Guidance document³ on addressing microbiological risks in fresh fruits and vegetables at primary production through good hygiene practices in 2017. It can therefore be expected that chlorate levels in foods are now lower compared with the levels found in the samples from 2011 to 2014.

1.2. Terms of Reference (provided by the requestor)

In order to base the MRLs for chlorate on the latest available and the most robust monitoring data, the Commission therefore requested EFSA to provide a statistical analysis on chlorate occurrence levels in foods using the latest available samples from 2015 onwards, and to provide the same statistical analysis pooling all the available data from 2011 onwards.

The two statistical analysis are similar to the one performed in the scientific opinion "Risks for public health related to the presence of chlorate in food" (EFSA, 2015), with the difference that no statistical analysis is required for chlorate occurrence levels in drinking water.

¹ Mandate 2014-0208, EFSA question 2014-00534

² EFSA, 2015, Risks for public health related to the presence of chlorate in food, EFSA Journal 2015;13(6):4135, doi: 10.2903/j.efsa.2015.4135

³ Commission notice on guidance document on addressing microbiological risks in fresh fruits and vegetables at primary production through good hygiene, OJ C 163, 23.5.2017, p. 1

1.2.1. Analysis 1

- a. **Samples.** Samples collected and analysed by Member States, sent to EFSA for the specific chlorate data call and through the pesticide monitoring programme, avoiding duplicates
- b. **Sampling period.** From 2015 onwards (2015 to 2017). Sampling period corresponding to the data collected and pooled in the file CHLORATES_DC_OCC_MAY_2018.XLSX sent on 17 May 2018 (corrected for duplicates on 28 May 2018).
- c. **Food categories.** The results of the statistical analysis should be presented in the same tabulated format as the analysis performed with the data of the samples collected between 2011 and 2014 for the same food categories except drinking water:
 - FOODEX LEVEL 1
 - FOODEX LEVEL 2
 - FOODEX LEVEL 2 – specific categories (see below)
 - FOODEX LEVEL 3

FOODEX LEVEL 2 – specific categories:

- Root vegetables except carrots
 - Bulb vegetables except garlic
 - Fruiting vegetables except peppers, chili peppers, aubergines, cucumbers and courgettes
 - Brassica vegetables except broccoli
 - Leaf vegetables except Lettuce, excluding iceberg-type lettuce and excluding Spinach
 - Legume vegetables, Legumes, beans, green without pods and Legumes, beans, green, with pods: results of the 3 categories merged
 - Legume vegetables, Legumes, beans, green without pods (only peas green without pods and Lentils green of this category) and Legumes, beans, green, with pods results of the 3 categories merged
 - Stem vegetables except celery
 - Fungi, cultivated and Fungi, wild edible: results of both categories merged
 - Legumes, beans dried without oilseeds (peanuts and soy beans)
 - Spices except paprika powder
- d. **Statistics.** Mean, median, P75, P90, P95 - For lower, middle and upper bound

1.2.2. Analysis 2

- a. **Samples.** Same as for analysis 1
- b. **Sampling period.** From 2011 onwards (2011 to 2017). Sampling period corresponding to the data collected for the 2015 EFSA opinion on risks for public health related to the presence of chlorate in food on chlorate + the data collected and pooled in the file CHLORATES_DC_OCC_MAY_2018.XLSX sent on 17 May 2018 (corrected for duplicates on 28 May 2018).
- c. **Food categories.** Same as for analysis 1
- d. **Statistics.** Same as for analysis 1

1.3. Interpretation of the Terms of Reference

In order to address the Terms of Reference all the Chlorates⁴ occurrence data collected analysed and reported by Member States to EFSA from 2011 onwards were extracted from the two main data collections available in EFSA:

- Chemical Contaminants Occurrence data collection (DC_OCC_DWH)
- Pesticide Monitoring Data Collection (MOPER)

For pesticide monitoring Chlorates have been reportable since October 2014, so the pesticides monitoring data collection does not contain data reported before 2014.

The chlorate data extracted from the two data collections (DC_OCC_DWH and MOPER) were harmonized and merged, covering the period 2011-2017. (For 2017 limited results were available as the request was received before all the 2017 data had been submitted and validated).

Merging Chemical Contaminants with Pesticides data and performing the statistical analysis based on the Foodex1 classification system implied the recoding of all the Pesticides samples according to Foodex1.

Duplicates results were identified and removed. The statistical analysis was replicated for the two periods 2011-2017 and 2015-2017.

Food categories for both the analysis periods in the merged dataset were enriched with the Foodex1 Level 2 specific categories created as requested in the Mandate. The specific categories were implemented by applying aggregations at Foodex1 Level 2 after excluding specific elements at the more detailed Level 3. For example the specific category "Root vegetables except carrots" implies the aggregation of all the data reported for Level 2 category "Root vegetables" (code A.01.000318 which at Level 3 includes: Beetroot, Carrots, Celeriac, Horseradish, Parsley root, Parsnips, Radishes, Salsify, Swedes and Turnips) after excluding results reported for Carrots. With regard to the food category "Legume vegetables, Legumes, beans, green" with and without pods, two specific categories were created (SPC1 and SPC2). Water samples were excluded as requested in the mandate.

1.3.1. Calculations

Lower, middle and upper bound values were calculated to address left censored data (Table 1:).

Table 1: Calculation of lower, middle and upper bound

Calculated Field	Calculation
Lower Bound (RESVAL_LB)	if RESVAL (Result Value) is reported then RESVAL else 0
Middle Bound (RESVAL_MB)	if RESVAL is reported then RESVAL else RESLC/2
Upper Bound (RESVAL_UB)	if RESVAL is reported then RESVAL else RESLC

Where RESLC is defined as follows:

WHEN Type of result (RESTYPE) = "LOD" then RESLOD,
WHEN RESTYPE = "LOQ" then RESLOQ,

⁴ Chlorates are reported with the paramCode RF-00000015-CHE according to the PARAM catalogue of the Standard Sample Description (SSD) controlled terminologies

WHEN RESTYPE = "CCA" then CCALPHA,
WHEN RESTYPE = "CCB" then CCBETA
Else 0

The requested statistics (Mean, median, 75th Percentile, 90th percentile, 95th percentile) were calculated for the lower bound, middle bound and upper bound respectively for the two time periods and based on the three Foodex1 levels requested (L1, L2 and L3) as well as on the specific categories created ad hoc for this statistical analysis (SPC1, SPC2). Additionally for each table the number of samples and the percentage of Left Censored were calculated.

Two releases of statistics were delivered to the European Commission. A preliminary analysis (delivered the 31st of August 2018) included all the results of the Chemical Contaminant and Pesticides monitoring data collections currently stored in the EFSA Data Warehouse. A final analysis (delivered the 18th of September 2018) included minor cleaning and recoding in line with the dataset processed for the opinion "Risks for public health related to the presence of chlorate in food" (EFSA, 2015).

Additionally, EFSA added to the final release a new column with the calculation of the highest reliable percentile for all the food categories.

2. Data and Methodologies

2.1. Data

2.1.1. Chemical contaminants data collection (DC_OCC_DWH)

2.1.1.1. Number of results

21,163 valid analytical results were extracted from the DC_OCC_DWH data collection from 2011 to 2017 distributed as follows over the years:

Table 2: Chemical contaminants results extracted by year

Year	Number of valid results
2011	61
2012	70
2013	1932
2014	9006
2015	7191
2016	2413
2017	490

2.1.1.2. Removal of duplicates

Checking the unique identifiers of samples and result, duplicate and triplicate records were identified in the Chemical Contaminants data collection. This was due to repeated data transmissions by two countries (Germany and The Netherlands) which reported more than once the same results in the frame of different data collections ran in 2013 and 2014. This was still possible in 2013 and 2014 because no cross-data collection checks of duplicates were performed by the automated validation process applied to incoming transmissions at that time.

As a consequence a total of 336 double or triple reported results were identified and eliminated from the initial dataset extracted from the Chemical Contaminants which was resized to 20807 results.

2.1.1.3. Additional cleaning

Cleaning of the dataset as performed for the 2015 Opinion:

- Samples of "Potatoes, peeled" with foodex code 'G.4.8.2' were recoded to "Main-crop potatoes" (foodex code 'A.01.000470')
- Samples of "Sweet potatoes" with foodex code 'G.4.9' were recoded to 'Sweet potatoes (Ipomoea batatas)' (code 'A.01.000481')
- 1 sample eliminated (labsampcode = '-7543408484811045111') in order to exclude from the statistics a resLOQ > 1000 (1 order of magnitude higher than the average in the same food category)
- Exclusion of samples originated in South Africa or Thailand (ZA – TH).
- Exclusion of samples where FOODEX_CODE_L2 = 'A.01.000002' (Grain crops considered feed).
- Exclusion of samples where the sampling strategy was reports as "suspect sampling" (PROGSAMPSTRATEGY = 'ST30A')
- Exclusion of samples of processed water that was reported as drinking water (FOODEX_CODE_L1 = 'A.01.001573' and specific description in the prod text like "PROCESS WEATER", "PROCESS WATER, BLANCHED"...)

The impact of the cleaning operations in terms of data loss is listed in Table 3: .

Table 3: Cleaning operations applied in line with the 2015 opinion and number of results affected

CLEANING OPERATION	RESULTS AFFECTED
<i>CHANGE OF CATEOGRY: Potatoes, peeled --> Main-crop potatoes</i>	2
<i>CHANGE OF CATEOGRY: Sweet potatoe --> Sweet potatoes (Ipomoea batatas)</i>	6
RESULT ELIMINATED - High LOQ > 1000	1
RESULT ELIMINATED: Grains as crops considered as feed	18
RESULT ELIMINATED: Sampling country is South Africa or Thailandia	27
RESULT ELIMINATED: processed water	48
RESULT ELIMINATED: suspect sampling	725
TOTAL NUMBER OF RESULTS INVOLVED	827
TOTAL NUMBER OF RESULTS EXCLUDED	819

After the data cleaning the total number of results retained from the Chemical Contaminants data collection amounted to 19988, which were further checked for duplicates with the MOPER data collections.

2.1.2. Pesticide monitoring data collection (MOPER)

2.1.2.1. Number of results

A total of 15711 valid analytical results were extracted from the pesticides monitoring data collections distributed as follows over the years:

No duplicates were found in this dataset

Table 4: Results extracted by year

Year	Number of valid results
2014	4911
2015	5527
2016	5273

2.1.2.2. Removal of duplicates

Checks on possible duplicates of Chlorates data in both the Pesticides Monitoring and the Chemical Contaminants data collections were performed and 7575 double reported German samples were identified and excluded (2592 samples in 2014 and 4983 samples in 2015) reducing the pesticides dataset to 8136 analytical results.

Additional cleaning of the datasets as performed for the 2015 Opinion:

- Exclusion of samples where FOODEX_CODE_L2 = 'A.01.000002' (Grain crops considered feed).
- Exclusion of samples where the sampling strategy was reports as "suspect sampling" (PROGSAMPSTRATEGY = 'ST30A')

The impacts of the cleaning operations in terms of data loss are listed in Table 5: .

Table 5: Cleaning operations applied in line with the 2015 opinion and number of results affected

CLEANING OPERATION	RESULTS AFFECTED
RESULT ELIMINATED: Grains as crops considered as feed	46
RESULT ELIMINATED: suspect sampling	45
TOTAL NUMBER OF RESULTS INVOLVED	91
TOTAL NUMBER OF RESULTS EXCLUDED	91

After the data cleaning 8045 results were retained from the Pesticide Monitoring data collection.

2.2. Methodologies

2.2.1. Pooled chlorates dataset

The table structure of all the pesticides and chemical contaminants datasets was harmonized in order to perform the merge operation of all the available tables and get a final unique dataset of Chlorates occurrence.

The merge operation generated a unique, clean and harmonized dataset composed by 28,033 analytical results covering the period 2011-2017. The subset analysed for the period 2015-2017 includes 15,741 analytical results.

The Foodex1 Level 2 specific categories were introduced in the final harmonized dataset following the interpretation of the term of reference.

The transformations applied to derive the specific categories from Foodex1 level 2 are implemented and described in the Excel workbook "FoodEx_Level2_spec_categories_chlorates_analysis.xlsx" delivered with the final statistics.

3. Results

3.1. Statistical analysis

The statistical analysis was performed according to the terms of reference.

Table 6: Statistics calculated according to the terms of reference and corresponding fields in the final output tables.

Description	Field name
Number of samples	N_samples
Percentage of Left Censored	Perc_LC
Mean of the Lower Bound	MEAN_LOW
Median of the Lower Bound	median_LOW
75 th percentile of the Lower Bound	p75_LOW
90 th percentile of the Lower Bound	p90_LOW
95 th percentile of the Lower Bound	P95_LOW
Mean of the Middle Bound	MEAN_MID
Median of the Middle Bound	median_MID
75 th percentile of the Middle Bound	p75_MID
90 th percentile of the Middle Bound	p90_MID
95 th percentile of the Middle Bound	P95_MID
Mean of the Upper Bound	MEAN_HIGH
Median of the Upper Bound	median_HIGH
75 th percentile of the Upper Bound	p75_HIGH
90 th percentile of the Upper Bound	p90_HIGH
95 th percentile of the Upper Bound	P95_HIGH

3.2. Reliability of high percentiles

The calculation of the highest reliable percentile for all the food categories was performed according to statistical robustness criteria defined by EFSA and specified in a worksheet added to each workbook delivered. This information is present for all the records in the last column of all the delivered workbooks.

The reliability of high percentiles of chemical occurrence data is related to the number of samples (analytical results) used to calculate them. Percentiles calculated on a limited number of samples should be treated with caution as the results may not be statistically robust.

As pointed out by EFSA (2011)⁵, clear indication concerning the minimum number of observations necessary to estimate a given percentile cannot be found in the literature. Different options can be used, none of them being a widely accepted standard. The non-parametric method proposed by EFSA (2011) is here used to set the minimum number of samples for which percentiles can be considered as reliable (Table 7:). Occurrence statistics for less than 5 samples should not be considered reliable unless other information is available.

Table 7: Highest reliable percentile based on the number of samples

Number of samples		Highest reliable percentile
Minimum	Maximum	
5	11	Median
12	29	75 th percentile
30	60	90 th percentile
61	180	95 th percentile
181	298	97.5 th percentile
299		99 th percentile

⁵ European Food Safety Authority; Use of the EFSA Comprehensive European Food Consumption Database in Exposure Assessment. EFSA Journal 2011;9(3):2097. [34 pp.] doi:10.2903/j.efsa.2011.2097. Available online: www.efsa.europa.eu/efsajournal.htm

Table 8: List of statistical tables delivered in Excel format and respective contents

Filename	Description
CHLORATES_STATS_11_17_L1.XLSX	Statistics on chlorates (chemical occurrence data collection + pesticides data collections) - Data submitted in the period 2011 to 2017 - Statistics based on Foodex1 Level 1
CHLORATES_STATS_11_17_L2.XLSX	Statistics on chlorates (chemical occurrence data collection + pesticides data collections) - Data submitted in the period 2011 to 2017 - Statistics based on Foodex1 Level 2 (labels of the upper Foodex levels included)
CHLORATES_STATS_11_17_L3.XLSX	Statistics on chlorates (chemical occurrence data collection + pesticides data collections) - Data submitted in the period 2011 to 2017 - Statistics based on Foodex Level 3 (labels of the upper Foodex levels included)
CHLORATES_STATS_15_17_L1.XLSX	Statistics on chlorates (chemical occurrence data collection + pesticides data collections) - Data submitted in the period 2015 to 2017 - Statistics based on Foodex1 Level 1
CHLORATES_STATS_15_17_L2.XLSX	Statistics on chlorates (chemical occurrence data collection + pesticides data collections) - Data submitted in the period 2015 to 2017 - Statistics based on Foodex1 Level 2 (labels of the upper Foodex levels included)
CHLORATES_STATS_15_17_L3.XLSX	Statistics on chlorates (chemical occurrence data collection + pesticides data collections) - Data submitted in the period 2015 to 2017 - Statistics based on Foodex Level 3 (labels of the upper Foodex levels included)
CHLORATES_STATS_11_17_SPC1.XLSX	Statistics on chlorates (chemical occurrence data collection + pesticides data collections) - Dataset manipulating accordint with the provisions for the Foodex1 Level2 specific categories - water excluded - Data submitted in the period 2011 to 2017 - Statistics based on Foodex1 Level2 Specific category1
CHLORATES_ST_11_17_SPC1_L3.XLSX	Statistics on chlorates (chemical occurrence data collection + pesticides data collections) - Dataset manipulating according with the provisions for the Foodex1 Level2 specific categories - water excluded - Data submitted in the period 2011 to 2017 - Statistics based on Foodex1 Level 3 (labels of the upper level2 specific category 1 included)
CHLORATES_STATS_11_17_SPC2.XLSX	Statistics on chlorates (chemical occurrence data collection + pesticides data collections) - Dataset manipulating according with the provisions for the Foodex1 Level2 specific categories - water excluded - Data submitted in the period 2011 to 2017 - Statistics based on Foodex1 Level2 Specific category2
CHLORATES_ST_11_17_SPC2_L3.XLSX	Statistics on chlorates (chemical occurrence data collection + pesticides data collections) - Dataset manipulating according with the provisions for the Foodex1 Level2 specific categories - water excluded - Data submitted in the period 2011 to 2017 - Statistics based on Foodex1 Level 3 (labels of the upper level2 specific category 2 included)

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CHLORATES_STATS_15_17_SPC1.XLSX Statistics on chlorates (chemical occurrence data collection + pesticides data collections) - Dataset manipulating according with the provisions for the Foodex1 Level2 specific categories - water excluded - Data submitted in the period 2015 to 2017 - Statistics based on Foodex1 Level2 Specific category1

CHLORATES_ST_15_17_SPC1_L3.XLSX Statistics on chlorates (chemical occurrence data collection + pesticides data collections) - Dataset manipulating according with the provisions for the Foodex1 Level2 specific categories - water excluded - Data submitted in the period 2015 to 2017 - Statistics based on Foodex1 Level 3 (labels of the upper level2 specific category 1 included)

CHLORATES_STATS_15_17_SPC2.XLSX Statistics on chlorates (chemical occurrence data collection + pesticides data collections) - Dataset manipulating according with the provisions for the Foodex1 Level2 specific categories - water excluded - Data submitted in the period 2015 to 2017 - Statistics based on Foodex1 Level2 Specific category2

CHLORATES_ST_15_17_SPC2_L3.XLSX Statistics on chlorates (chemical occurrence data collection + pesticides data collections) - Dataset manipulating according with the provisions for the Foodex1 Level2 specific categories - water excluded - Data submitted in the period 2015 to 2017 - Statistics based on Foodex1 Level 3 (labels of the upper level2 specific category 2 included)

Abbreviations

DCF	Data collection framework
DWH	Data Warehouse
EC	European Commission
LB	Lower Bound
MB	Middle Bound
MRL	Maximum residue level
P75	75 th percentile
P90	90 th percentile
P95	95 th percentile
UB	Upper Bound

Appendix A – Data transformation

A.1. Pesticides food coding transformation

Table 9: Matrix to Foodex1 categories transformation for pesticides data

Food Item (Matrix)	Treatment	FOODEX1 CODE	FOODEX1 NAME
Fruits and nuts	Unprocessed	A.01.000544	Fruit and fruit products
Grapefruits	Unprocessed	A.01.000546	Grapefruit (Citrus paradisi)
Oranges	Juicing	A.01.001397	Juice, Orange
Oranges	Unprocessed	A.01.000547	Oranges (Citrus sinensis)
Lemons	Unprocessed	A.01.000548	Lemons (Citrus limon)
Limes	Unprocessed	A.01.000549	Limes (Citrus aurantifolia)
Mandarins	Unprocessed	A.01.000550	Mandarins (Citrus reticulata)
Cashew nuts	Unprocessed	A.01.000517	Cashew nuts (Anacardium occidentale)
Chestnuts	Unprocessed	A.01.000518	Chestnuts (Castanea sativa)
Apples	Juicing	A.01.001396	Juice, Apple
Apples	Unprocessed	A.01.000553	Apple (Malus domestica)
Pears	Juicing	A.01.001407	Juice, Pear
Pears	Unprocessed	A.01.000554	Pear (Pyrus communis)
Quinces	Unprocessed	A.01.000555	Quince (Cydonia oblonga)
Medlars	Unprocessed	A.01.000556	Medlar (Mespilus germanica)
Apricots	Dehydration	A.01.000651	Dried apricots (Prunus armeniaca)
Apricots	Unprocessed	A.01.000563	Apricots (Prunus armeniaca)
Cherries	Juicing	A.01.001395	Fruit juice
Cherries	Freezing	A.01.000568	Sweet cherry (Prunus avium)
Cherries	Unprocessed	A.01.000568	Sweet cherry (Prunus avium)
Peaches	Unprocessed	A.01.000573	Peaches (Prunus persica)
Plums	Dehydration	A.01.000650	Dried prunes (Prunus domestica)
Plums	Freezing	A.01.000564	Plums (Prunus domestica)
Plums	Unprocessed	A.01.000564	Plums (Prunus domestica)
Table grapes	Dehydration	A.01.000648	Dried vine fruits (currants, raisins and sultanas)
Table grapes	Unprocessed	A.01.000576	Table grapes (Vitis euveitidis)
Wine grapes	Juicing	A.01.001401	Juice, Grape
Wine grapes	Wine production	A.01.001541	Wine
Wine grapes	Unprocessed	A.01.000577	Wine grapes (Vitis euveitidis)
Strawberries	Freezing	A.01.000578	Strawberries (Fragaria × ananassa)
Strawberries	Unprocessed	A.01.000578	Strawberries (Fragaria × ananassa)
Blackberries	Freezing	A.01.000579	Blackberries (Rubus fruticosus)
Blackberries	Unprocessed	A.01.000579	Blackberries (Rubus fruticosus)
Raspberries	Freezing	A.01.000581	Raspberries (Rubus idaeus)

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Food Item (Matrix)	Treatment	FOODEX1 CODE	FOODEX1 NAME
Raspberries	Unprocessed	A.01.000581	Raspberries (<i>Rubus idaeus</i>)
Blueberries	Freezing	A.01.000583	Blueberries (<i>Vaccinium corymbosum</i>)
Blueberries	Unprocessed	A.01.000583	Blueberries (<i>Vaccinium corymbosum</i>)
Cranberries	Unprocessed	A.01.000584	Cranberries (<i>Vaccinium macrocarpon</i>)
Currants	Freezing	A.01.000585	Currants (red, black and white) (<i>Ribes nigrum</i> , <i>Ribes rubrum</i>)
Currants	Unprocessed	A.01.000585	Currants (red, black and white) (<i>Ribes nigrum</i> , <i>Ribes rubrum</i>)
Gooseberries	Unprocessed	A.01.000586	Gooseberries (<i>Ribes uva-crispa</i>)
Dates	Dehydration	A.01.000654	Dried dates (<i>Phoenix dactylifera</i>)
Dates	Unprocessed	A.01.000612	Dates (<i>Phoenix dactylifera</i>)
Figs	Dehydration	A.01.000649	Dried figs (<i>Ficus carica</i>)
Figs	Unprocessed	A.01.000613	Figs (<i>Ficus carica</i>)
Kumquats	Unprocessed	A.01.000615	Kumquats (<i>Fortunella</i> species)
Carambolas	Unprocessed	A.01.000616	Carambola (<i>Averrhoa carambola</i>)
Persimmon	Unprocessed	A.01.000617	Persimmon (Sharon fruit) (<i>Diospyros kaki</i>)
Kiwi fruits	Unprocessed	A.01.000619	Kiwi (<i>Actinidia deliciosa</i> syn. <i>A. chinensis</i>)
Lychees	Unprocessed	A.01.000620	Lychee (Litchi) (<i>Litchi chinensis</i>)
Passionfruits	Unprocessed	A.01.000621	Passion fruit (<i>Passiflora edulis</i>)
Prickly pears	Unprocessed	A.01.000622	Prickly pear (cactus fruit) (<i>Opuntia ficus-indica</i>)
Avocados	Unprocessed	A.01.000625	Avocados (<i>Persea americana</i>)
Bananas	Unprocessed	A.01.000626	Bananas (<i>Musa × paradisiaca</i>)
Mangoes	Unprocessed	A.01.000627	Mangoes (<i>Mangifera indica</i>)
Papayas	Unprocessed	A.01.000628	Papaya (<i>Carica papaya</i>)
Pomegranates	Unprocessed	A.01.000629	Pomegranate (<i>Punica granatum</i>)
Cherimoyas	Unprocessed	A.01.000630	Cherimoya (<i>Annona cherimola</i>)
Guavas	Unprocessed	A.01.000631	Guava (<i>Psidium guajava</i>)
Pineapples	Juicing	A.01.001399	Juice, Pineapple
Pineapples	Unprocessed	A.01.000632	Pineapples (<i>Ananas comosus</i>)
Vegetables	Unprocessed	A.01.000317	Vegetables and vegetable products (including fungi)
Vegetables, not specified	Processed	A.01.000440	Vegetable products
Potatoes	Unprocessed	A.01.000468	Potatoes and potatoes products
Sweet potatoes	Unprocessed	A.01.000481	Sweet potatoes (<i>Ipomoea batatas</i>)
Beetroots	Unprocessed	A.01.000320	Beetroot (<i>Beta vulgaris</i> subsp. <i>vulgaris</i>)
Carrots	Freezing	A.01.000321	Carrots (<i>Daucus carota</i>)
Carrots	Unprocessed	A.01.000321	Carrots (<i>Daucus carota</i>)
Celeriacs	Unprocessed	A.01.000322	Celeriac (<i>Apium graveolens</i> var. <i>rapaceum</i>)
Horseradishes	Unprocessed	A.01.000323	Horseradish (<i>Armoracia rusticana</i>)
Jerusalem artichokes	Unprocessed	A.01.000485	Jerusalem artichokes tubers (<i>Helianthus tuberosus</i>)
Parsnips	Unprocessed	A.01.000325	Parsnips (<i>Pastinaca sativa</i>)
Parsley roots	Unprocessed	A.01.000324	Parsley root (<i>Petroselinum crispum</i>)
Radishes	Unprocessed	A.01.000326	Radishes (<i>Raphanus sativus</i> var. <i>sativus</i>)

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Food Item (Matrix)	Treatment	FOODEX1 CODE	FOODEX1 NAME
Salsifies	Freezing	A.01.000327	Salsify (<i>Tragopogon porrifolius</i>)
Salsifies	Unprocessed	A.01.000327	Salsify (<i>Tragopogon porrifolius</i>)
Swedes	Unprocessed	A.01.000328	Swedes (<i>Brassica napus</i> var. <i>napobrassica</i>)
Garlic	Unprocessed	A.01.000332	Garlic, bulb (<i>Allium sativum</i>)
Onions	Freezing	A.01.000333	Onions, bulb (<i>Allium cepa</i>)
Onions	Unprocessed	A.01.000333	Onions, bulb (<i>Allium cepa</i>)
Shallots	Unprocessed	A.01.000334	Shallots, bulb (<i>Allium ascalonicum</i> , <i>Allium cepa</i> var. <i>aggregatum</i>)
Spring onions	Unprocessed	A.01.000335	Spring onions, bulb (<i>Allium cepa</i>)
Tomatoes	Processed	A.01.000338	Tomatoes (<i>Lycopersicum esculentum</i>)
Tomatoes	Juicing	A.01.001455	Juice, Tomato
Tomatoes	Unprocessed	A.01.000338	Tomatoes (<i>Lycopersicum esculentum</i>)
Sweet peppers	Dehydration	A.01.001594	Paprika powder
Sweet peppers	Freezing	A.01.000339	Peppers, paprika (<i>Capsicum annuum</i> , var. <i>grossum</i> and var. <i>longum</i>)
Sweet peppers	Unprocessed	A.01.000339	Peppers, paprika (<i>Capsicum annuum</i> , var. <i>grossum</i> and var. <i>longum</i>)
Aubergines	Unprocessed	A.01.000341	Aubergines (egg plants) (<i>Solanum melongena</i>)
Okra	Unprocessed	A.01.000342	Okra, lady's fingers (<i>Hibiscus esculentus</i>)
Cucumbers	Unprocessed	A.01.000343	Cucumbers (<i>Cucumis sativus</i>)
Courgettes	Unprocessed	A.01.000345	Courgettes (Zucchini) (<i>Cucurbita pepo</i> var. <i>melo</i>)
Melons	Unprocessed	A.01.000346	Melons (<i>Cucumis melo</i>)
Pumpkins	Unprocessed	A.01.000347	Pumpkins (<i>Cucurbita maxima</i>)
Watermelons	Unprocessed	A.01.000348	Watermelons (<i>Citrullus lanatus</i>)
Sweet corn	Unprocessed	A.01.000349	Sweet corn (<i>Zea mays</i> var. <i>saccharata</i>)
Broccoli	Freezing	A.01.000351	Broccoli (<i>Brassica oleracea</i> var. <i>italica</i>)
Broccoli	Unprocessed	A.01.000351	Broccoli (<i>Brassica oleracea</i> var. <i>italica</i>)
Cauliflowers	Freezing	A.01.000352	Cauliflower (<i>Brassica oleracea</i> var. <i>botrytis</i>)
Cauliflowers	Unprocessed	A.01.000352	Cauliflower (<i>Brassica oleracea</i> var. <i>botrytis</i>)
Brussels sprouts	Freezing	A.01.000353	Brussels sprouts (<i>Brassica oleracea</i> var. <i>gemmifera</i>)
Brussels sprouts	Unprocessed	A.01.000353	Brussels sprouts (<i>Brassica oleracea</i> var. <i>gemmifera</i>)
Head cabbages	Unprocessed	A.01.000354	Head cabbage (<i>Brassica oleracea</i> convar. <i>capitata</i>)
Chinese cabbages	Unprocessed	A.01.000355	Chinese cabbage (<i>Brassica pekinensis</i>)
Kales	Freezing	A.01.000356	Kale (<i>Brassica oleracea</i> convar. <i>Acephalea</i>)
Kales	Unprocessed	A.01.000356	Kale (<i>Brassica oleracea</i> convar. <i>Acephalea</i>)
Kohlrabies	Unprocessed	A.01.000357	Kohlrabi (<i>Brassica oleracea</i> convar. <i>acephala</i> , var. <i>gongylodes</i>)
Leaf vegetables, herbs and edible flowers, not specified	Unprocessed	A.01.000359	Leaf vegetables
Lamb's lettuces	Unprocessed	A.01.000360	Lamb's lettuce (<i>Valerianella locusta</i>)
Lettuces	Unprocessed	A.01.000361	Lettuce, excluding Iceberg-type lettuce (<i>Lactuca sativa</i>)
Escaroles	Unprocessed	A.01.000363	Endive, scarole (broad-leaf endive) (<i>Cichorium endiva</i>)
Cresses and other sprouts and shoots	Unprocessed	A.01.000359	Leaf vegetables

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Food Item (Matrix)	Treatment	FOODEX1 CODE	FOODEX1 NAME
Rucola	Unprocessed	A.01.000366	Rocket, Rucola (<i>Eruca sativa</i> , <i>Diplotaxis spec.</i>)
Spinaches	Freezing	A.01.000369	Spinach (fresh) (<i>Spinacia oleracea</i>)
Spinaches	Unprocessed	A.01.000369	Spinach (fresh) (<i>Spinacia oleracea</i>)
Purslanes	Unprocessed	A.01.000371	Purslane (<i>Portulaca oleracea</i>)
Chards	Unprocessed	A.01.000372	Beet leaves (<i>Beta vulgaris</i>)
Witloofs	Unprocessed	A.01.000375	Witloof (<i>Cichorium intybus</i> . var. <i>foliosum</i>)
Herbs and edible flowers	Freezing	A.01.001581	Herbs
Herbs and edible flowers	Unprocessed	A.01.001581	Herbs
Herbs and edible flowers, not specified	Freezing	A.01.001581	Herbs
Herbs and edible flowers, not specified	Unprocessed	A.01.001581	Herbs
Chives	Unprocessed	A.01.001583	Chives, herb (<i>Allium schoenoprasum</i>)
Parsley	Freezing	A.01.001586	Parsley, herb (<i>Petroselinum crispum</i>)
Parsley	Unprocessed	A.01.001586	Parsley, herb (<i>Petroselinum crispum</i>)
Sage	Unprocessed	A.01.001587	Sage, herb (<i>Salvia officinalis</i>)
Rosemary	Unprocessed	A.01.001588	Rosemary, herb (<i>Rosmarinus officinalis</i>)
Thyme	Unprocessed	A.01.001589	Thyme, herb (<i>Thymus spp.</i>)
Basil and edible flowers	Unprocessed	A.01.001590	Basil, herb (<i>Ocimum basilicum</i>)
Bay leave	Unprocessed	A.01.001591	Bay leaves (laurel) (<i>Laurus nobilis</i>)
Fresh herbs and edible flowers, not specified	Unprocessed	A.01.001581	Herbs
Beans (with pods)	Canning	A.01.000383	Beans, with pods (<i>Phaseolus vulgaris</i>)
Beans (with pods)	Freezing	A.01.000383	Beans, with pods (<i>Phaseolus vulgaris</i>)
Beans (with pods)	Unprocessed	A.01.000383	Beans, with pods (<i>Phaseolus vulgaris</i>)
Beans (without pods)	Canning	A.01.000488	Beans, green, without pods (<i>Phaseolus vulgaris</i>)
Beans (without pods)	Freezing	A.01.000488	Beans, green, without pods (<i>Phaseolus vulgaris</i>)
Peas (with pods)	Unprocessed	A.01.000384	Peas, with pods (<i>Pisum sativum</i>)
Peas (without pods)	Canning	A.01.000489	Peas, green, without pods (<i>Pisum sativum</i>)
Peas (without pods)	Freezing	A.01.000489	Peas, green, without pods (<i>Pisum sativum</i>)
Peas (without pods)	Unprocessed	A.01.000489	Peas, green, without pods (<i>Pisum sativum</i>)
Asparagus	Unprocessed	A.01.000386	Asparagus (<i>Asparagus officinalis</i>)
Celeries	Unprocessed	A.01.000388	Celery (<i>Apium graveolens</i> var. <i>dulce</i>)
Fennels	Unprocessed	A.01.000389	Fennel (<i>Foeniculum vulgare</i>)
Globe artichokes	Unprocessed	A.01.000390	Globe artichokes (<i>Cynara scolymus</i>)
Leeks	Freezing	A.01.000391	Leek (<i>Allium porrum</i>)
Leeks	Unprocessed	A.01.000391	Leek (<i>Allium porrum</i>)
Rhubarbs	Unprocessed	A.01.000392	Rhubarb (<i>Rheum × hybridum</i>)
Cultivated fungi	Dehydration	A.01.000453	Fungi, cultivated
Cultivated fungi	Freezing	A.01.000453	Fungi, cultivated
Cultivated fungi	Unprocessed	A.01.000453	Fungi, cultivated

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Food Item (Matrix)	Treatment	FOODEX1 CODE	FOODEX1 NAME
Wild fungi	Dehydration	A.01.000458	Fungi, wild, edible
Wild fungi	Freezing	A.01.000458	Fungi, wild, edible
Wild fungi	Unprocessed	A.01.000458	Fungi, wild, edible
Beans (dry)	Unprocessed	A.01.000492	Beans (<i>Phaseolus vulgaris</i>)
Lentils (dry)	Unprocessed	A.01.000493	Lentils (<i>Lens culinaris</i> syn. <i>L. esculenta</i>)
Peas (dry)	Unprocessed	A.01.000494	Peas (<i>Pisum sativum</i>)
Linseeds	Unprocessed	A.01.000528	Linseed (<i>Linum usitatissimum</i>)
Sesame seeds	Unprocessed	A.01.000531	Sesame seed (<i>Sesamum indicum</i> syn. <i>S. orientale</i>)
Sunflower seeds	Oil production	A.01.000532	Sunflower seed (<i>Helianthus annuus</i>)
Sunflower seeds	Unprocessed	A.01.000532	Sunflower seed (<i>Helianthus annuus</i>)
Rapeseeds	Unprocessed	A.01.000533	Rape seed (<i>Brassica napus</i>)
Soyabeans	Milling - refined flour	A.01.000504	Soya beans flour
Soyabeans	Unprocessed	A.01.000503	Soya beans (<i>Glycine max</i>)
Pumpkin seeds	Unprocessed	A.01.000537	Pumpkin seeds (<i>Cucurbita pepo</i> var. <i>oleifera</i>)
Olives for oil production	Oil production	A.01.001375	Olive oil
Barley	Unprocessed	A.01.000004	Barley grain
Buckwheat	Unprocessed	A.01.000008	Buckwheat grain
Buckwheat and other pseudo-cereals	Milling - refined flour	A.01.000067	Buckwheat milling products
Buckwheat and other pseudo-cereals	Unprocessed	A.01.000008	Buckwheat grain
Maize	Milling - refined flour	A.01.000072	Corn flour
Maize	Unprocessed	A.01.000022	Corn grain
Millet	Unprocessed	A.01.000028	Millet grain
Oat	Unprocessed	A.01.000029	Oats, grain
Rice	Unprocessed	A.01.000030	Rice
Rye	Milling - refined flour	A.01.000061	Rye flour, light
Rye	Unprocessed	A.01.000006	Rye grain
Wheat	Milling	A.01.000044	Wheat milling products
Wheat	Milling - refined flour	A.01.000047	Wheat flour, white
Wheat	Unprocessed	A.01.000014	Wheat grain
Teas	Unprocessed	A.01.000405	Tea (dried leaves and stalks, fermented or otherwise of <i>Camellia sinensis</i>)
Herbal infusions, dried	Unprocessed	A.01.000404	Tea and herbs for infusions (Solid)
Herbal infusions, not specified	Unprocessed	A.01.000404	Tea and herbs for infusions (Solid)
Hops	Unprocessed	A.01.000452	Hops (dried), including hop pellets and unconcentrated powder (<i>Humulus lupulus</i>)
Hops, dried	Unprocessed	A.01.000452	Hops (dried), including hop pellets and unconcentrated powder (<i>Humulus lupulus</i>)
Ginger	Unprocessed	A.01.001615	Ginger (<i>Zingiber officinale</i>)

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Food Item (Matrix)	Treatment	FOODEX1 CODE	FOODEX1 NAME
Turmeric/curcuma	Unprocessed	A.01.001624	Turmeric (Curcuma) (Curcuma domestica syn. C. longa)
Cloves	Unprocessed	A.01.001608	Cloves (Syzygium aromaticum)
Milk (cattle)	Churning - cheese	A.01.001348	Butter
Milk (cattle)	Unprocessed	A.01.000950	Cow milk
Milk (sheep)	Churning	A.01.001348	Butter
Milk (sheep)	Churning - cheese	A.01.001053	Cheese
Milk (goat)	Churning	A.01.001348	Butter
Milk (goat)	Churning - cheese	A.01.001053	Cheese
Milk (goat)	Unprocessed	A.01.000958	Goat milk
Milk (others species)	Churning - cheese	A.01.001053	Cheese
Eggs (chicken)	Unprocessed	A.01.001254	Whole egg, chicken
Honey and other apicultural products	Unprocessed	A.01.001341	Honey, monofloral
Baby foods other than processed cereal-based foods	Processed	A.01.001733	Ready-to-eat meal for infants and young children
Processed cereal-based foods for infants and young children	Processed	A.01.001728	Cereal-based food for infants and young children
Infant formulae	Processed	A.01.001716	Infant formulae
Follow-on formulae	Processed	A.01.001722	Follow-on formulae
DRINKING WATER	Unprocessed	A.01.001573	Drinking water (water without any additives except carbon dioxide; includes water ice for consumption)