



# Nutrient analysis of fruit and vegetables

*Summary report*



**Prepared by the Food Composition and Diet Team, Public Health Directorate**

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# Contents

Contents.....	4
Executive summary.....	5
Background.....	7
Methodology.....	7
Results.....	9
Interpretation.....	9
Further Information.....	10
Annex A: Details of composite samples analysed.....	11
Annex B: List of nutrients analysed.....	14
Annex C: Analytical data.....	15
Macronutrients.....	15
Micronutrients.....	20
Annex D: Analytical methods used.....	25
References.....	29

# Executive summary

**A survey to determine the nutrient composition of fruit and vegetables and some fruit/vegetable products has been carried out to provide up-to-date nutrient composition data for these foods, reflecting the increasing range of commonly consumed fruit and vegetables (eg pak choi, rocket and baby spinach).**

This survey, carried out by a consortium led by the Institute of Food Research (and including Susan Church (Independent Nutritionist), British Nutrition Foundation, Laboratory of the Government Chemist and Eurofins Laboratories), forms part of the Department of Health's<sup>1</sup> rolling programme of nutrient analysis which provides up-to-date and reliable information on the nutrient content of foods<sup>2</sup>. The results from this programme of work are incorporated into the Department of Health's nutrient databanks that support the National Diet and Nutrition Survey and other national dietary surveys. These national surveys are used by Government to monitor the nation's diet. This programme of work to determine the nutrient composition of foods is key to ensuring that estimates of nutrient intakes from dietary surveys are robust. The results of this survey will also be incorporated into the Composition of Foods Integrated Dataset<sup>3</sup> and future publications of *McCance and Widdowson's The Composition of Foods* series.

59 composite samples made up of a number of sub-samples were analysed for energy and a range of nutrients including carbohydrate, fat, fatty acids (including *trans*), protein, and a full range of vitamins and minerals. Results of these analyses are published here.

The list of composite samples to be analysed was determined using consumption and market share data, following consultation with expert users of UK food composition data (including representatives of the food industry, academia, catering suppliers, nutritionists and dietitians). Consideration was also given to types of fruit and vegetables where evidence has shown market growth. The composite samples selected were those fruit and vegetables that are most commonly consumed or where there were gaps in the data available and consumption was increasing (eg rocket and baby spinach). Market share information was used, and industry consulted, to determine the sub-samples included within each composite sample. Sub-samples included were based on the need to take into account factors including cultivar, region and country of origin, and season. Fresh fruit and vegetables were sampled in two seasons (summer/autumn and autumn/winter) where cultivars and geographic origin were known to change between seasons.

Each composite comprised of between 9 and 22 sub-samples. The sub-samples were purchased from retail outlets and prepared for analysis between August 2011 and February 2012, and were analysed for proximates and individual fatty acids between March and June 2012. Analyses for vitamins and minerals were carried out between March and October 2012.

## Nutrient analysis of fruit and vegetables

It is not possible to make robust comparisons between current data and existing data held for fruit and vegetables largely derived from earlier analytical surveys undertaken between 1982 and 1990. Since that time, there have been changes in agricultural practices (particularly the type of fertilizers used, as well as the cultivars grown and geographical origin of some produce) that might affect the nutrient composition of produce. There is also a high degree of natural variability in fruit and vegetables, with composition affected by many factors, including cultivar, growing conditions (e.g. soil composition, climate, fertilizer use) and post-harvest handling, distribution and storage. These results are broadly similar to existing data held. There is no evidence of major changes in the nutrient content of fruit and vegetables based on this survey and any changes are unlikely to be nutritionally significant in a varied diet.

# Background

The Department of Health undertakes a rolling programme of nutrient analysis surveys to ensure that reliable, up-to-date information on the nutritional value of foods is available for use in conjunction with food consumption data collected in dietary surveys to monitor the nutritional content of the nation's diet. Therefore, these nutrient surveys need to provide a single, robust set of nutrient values that is indicative of the potentially broad choice available to the consumer when selecting any particular type of food. As a result, composite samples made up of a number of different brands of fruit and vegetables and fruit/vegetable products have been analysed for this survey rather than samples made up of single brands, and a generic name is given to each composite.

The aim of this particular survey was to provide up-to-date nutrient composition data for a range of fruit and vegetables and fruit/vegetable products to reflect the increasing range commonly consumed and new types which are growing in popularity (eg pak choi, rocket and baby spinach).

# Methodology

A list of composite samples to be analysed was determined following consultation with expert users of UK food composition data (including representatives of the food industry, academia, catering suppliers, nutritionists and dietitians) using consumption and market share data. The samples selected were those fruit and vegetables that are most commonly consumed or fruit and vegetables where there were gaps in the data available and consumption was increasing. Market share information was used where available, and industry consulted to determine the sub-samples included within each composite. Sub-samples included were based on the need to take into account factors including cultivar, region and country of origin, and season. Fresh fruit and vegetables were sampled in two seasons (summer/autumn and autumn/winter) where cultivars and geographic origin were known to change between seasons.

1073 food samples were purchased from retail outlets in the Norwich area (including supermarkets, independent retailers and catering suppliers) and prepared for analysis between August 2011 and February 2012. The food samples consisted of various types of fresh, frozen and canned fruit and vegetables, fruit juice and some fruit/vegetable products (ie tomato puree, baked beans, potato products).

These food samples were combined into 59 composite samples for analysis. Where samples were purchased over two seasons, samples from each season were prepared and stored

## Nutrient analysis of fruit and vegetables

frozen until all sub-samples for a composite were available. Once all samples had been collected from both sampling points they were thawed and mixed in proportions to produce the final composite sample for analysis of all nutrients except folate and vitamin C. Analysis of these labile nutrients was undertaken at the time of seasonal sampling and sub-samples were frozen immediately and analysed as soon as possible following sampling. The analytical results for folate and vitamin C for composites purchased over two seasons are presented as an average of these two data points.

Each composite was made up of between 9 and 22 sub-samples of equivalent weight. This process allows a single, robust set of nutrient values to be derived for each composite, covering an appropriate cross-section of products available. The results of these analyses are published here. Sub-samples requiring preparation/cooking were prepared in accordance with manufacturers' instructions where available and normal domestic practices. They were then combined into composite samples for analysis. A full list of the composite food samples analysed is given in Annex A. The full sampling report is available at [www.dh.gov.uk/publications](http://www.dh.gov.uk/publications).

Composites were analysed for proximates and individual fatty acids between March and June 2012 and analysed for vitamins and minerals between March and October 2012. Each composite was analysed for a range of nutrients depending on the importance of the particular food as a dietary source for each nutrient, and existing compositional data available. A full list of nutrients is given in Annex B. The methods used to conduct the analyses are included at Annex D.

Values provided by analytical laboratories were compiled in Excel spreadsheets for data evaluation. Where possible, analytical values were compared to other sources of comparable data, such as UK Food Composition tables, other food composition tables and information from manufacturers and retailers. Where applicable, ingredients lists were also evaluated to check that the values reported corresponded to the ingredients included in the samples. Where analytical values appeared incorrect or questionable, data was checked against original laboratory reports and re-analysed if necessary.

# Results

Each of the composite samples was analysed for an extensive range of nutrients, and therefore this project generated a large number of individual results. A summary of results for energy, protein, carbohydrate, fat and fatty acids, fibre, cholesterol, vitamins and minerals is provided in Annex C. The full set of results are provided in the analytical report associated with this project which is available at [www.dh.gov.uk/publications](http://www.dh.gov.uk/publications).

# Interpretation

This survey has determined the nutrient composition of fruit and vegetables and some fruit/vegetable products including those for which the market is growing.

The results from this survey provide us with robust, up-to-date data, which will be incorporated into the Department of Health's nutrient databanks which support our National Diet and Nutrition Survey and other national dietary surveys enabling the Government to monitor the nation's diet. The results of this survey will also be incorporated into future publications in the *McCance and Widdowson's The Composition of Foods* series.

It is not possible to make robust comparisons between current data and existing data held for fruit and vegetables largely derived from earlier analytical surveys undertaken between 1982 and 1990. Since that time, there have been changes in agricultural practices (particularly the type of fertilizers used, as well as the cultivars grown and geographical origin of some produce) that might affect the nutrient composition of produce. There is also a high degree of natural variability in fruit and vegetables, with composition affected by many factors, including cultivar, growing conditions (e.g. soil composition, climate, fertilizer use) and post-harvest handling, distribution and storage. These results are broadly similar to existing data held. There is no evidence of major changes in the nutrient content of fruit and vegetables based on this survey and any changes are unlikely to be nutritionally significant in a varied diet.

## Further Information

The report of this survey (entitled Nutrient analysis fruit and vegetables) is available at [www.dh.gov.uk/publications](http://www.dh.gov.uk/publications).

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# Annex A: Details of composite samples analysed

Sample Number	Sample Name
1	Potatoes, old, raw, flesh only
2	Potatoes, old, boiled, flesh only
3	Potatoes, old, baked, flesh and skin
4	Potatoes, old, roasted, flesh only
5	Potatoes, old, potato wedges, with skin, dipped in sunflower oil, baked
6	Potatoes, old, microwaved, flesh and skin
7	Potatoes, new, boiled, flesh and skin
8	Carrots, old, raw
9	Carrots, old, boiled
10	Carrots, old, microwaved
11	Onions, raw
12	Onions, boiled
13	Onions, fried
14	Broccoli (Calabrese), raw
15	Broccoli (Calabrese), boiled
16	Broccoli (Calabrese), steamed
17	Mushrooms, raw
18	Mushrooms, stewed
19	Mushrooms, cooked in sunflower oil
20	Sweetcorn, kernels, boiled 'on the cob'

## Nutrient analysis of fruit and vegetables

21	Cabbage, white, raw
22	Cabbage, green, raw
23	Cabbage, green, boiled
24	Cauliflower, raw
25	Cauliflower, boiled
26	Beans, green, raw
27	Beans, green, boiled
28	Pak choi, steamed
29	Tomatoes (standard),raw
30	Tomatoes (standard), grilled, flesh and seeds only
31	Tomatoes, cherry, raw
32	Lettuce, average, raw
33	Spinach, baby, raw
34	Rocket, raw
35	Cucumber, flesh and skin, raw
36	Pepper, red, raw
37	Pepper, red, boiled
38	Pepper, yellow, raw
39	Bananas, raw, flesh only
40	Apples, eating, raw, flesh and skin
41	Apples, cooking, stewed, flesh only
42	Pears, raw, flesh and skin
43	Grapes, green, raw
44	Grapes, red, raw

## Nutrient analysis of fruit and vegetables

45	Strawberries, raw
46	Blueberries, raw
47	Citrus fruit, soft/easy peelers, flesh only
48	Oranges, flesh only
49	Melon, yellow flesh, flesh only
50	Peas, frozen, raw
51	Peas, frozen, microwaved
52	Sweetcorn, canned in water, drained
53	Tomatoes, canned, whole contents
54	Tomato puree
55	Baked beans in tomato sauce
56	Potato products, shaped, frozen, baked
57	Orange juice, chilled (premium and from concentrate)
58	Orange juice, from concentrate, ambient
59	Apple juice, clear, from concentrate, ambient and chilled

## Annex B: List of nutrients analysed

Proximates	Water Protein (nitrogen and nitrogen factor) Fat Dry Ash content
Fatty acids	Individual fatty acids ( <i>cis</i> & <i>trans</i> isomers, positional isomers, branched chain) (expressed as percentage total fatty acids and per 100g food)
Sterols	Cholesterol
Carbohydrate	(All expressed as monosaccharide equivalents) Starch, total sugars, total carbohydrate, glucose, fructose, sucrose, maltose, lactose, galactose Oligosaccharides
Fibre	As non-starch polysaccharide i.e. Englyst method, and AOAC method
Inorganics	Sodium, potassium, calcium, magnesium, phosphorus, iron, copper, zinc, chloride, manganese, iodine, selenium
Water soluble vitamins	Thiamin, riboflavin, niacin, tryptophan (to calculate niacin equivalent), vitamin B <sub>6</sub> , vitamin B <sub>12</sub> , folate, pantothenic acid, biotin, vitamin C
Vitamin A	Retinol, carotenoids (alpha-carotene, beta-carotene, cryptoxanthins)
Other carotenoids	Lutein, lycopene, zeaxanthin
Vitamin D	Vitamin D <sub>3</sub> , 25-OH vitamin D
Vitamin E	Alpha-tocopherol, beta-tocopherol, delta-tocopherol, gamma-tocopherol, alpha-tocotrienol, gamma-tocotrienol

**Note:** Each of the samples was analysed for a range of nutrients in the above list, depending on existing compositional data available and the importance of fruit and vegetables as a dietary source of each nutrient

# Annex C: Analytical data

## Macronutrients

Composite sample number	Sample description	Water g/100g	Protein g/100g	Total fat g/100g	Ash g/100g	Carbohydrate g/100g	Energy (kcal)/100g	Energy (kJ)/100g	Englyst fibre g/100g	AOAC fibre g/100g	Starch g/100g	Total sugars g/100g	Glucose g/100g	Fructose g/100g	Sucrose g/100g	Maltose g/100g	Lactose g/100g	Oligosaccharides g/100g	Saturated fatty acids g/100g	Cis-monounsaturated fatty acids g/100g	Cis-n3 fatty acids g/100g	Cis-n6 fatty acids g/100g	Cis-polyunsaturated fatty acids g/100g	Trans fatty acids g/100g	Cholesterol milligrams/100g
1	Potatoes, old, raw, flesh only	78.1	1.9	0.1	0.9	19.6	82	349	0.8	2.0	18.7	0.9	0.5	0.4	<0.1	<0.1	<0.1	N/A	0.03	0.01	<0.01	0.01	0.01	<0.01	N/A
2	Potatoes, old, boiled, flesh only	78.9	1.8	0.1	0.8	17.5	74	315	1.0	1.6	16.7	0.8	0.3	0.3	0.2	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3	Potatoes, old, baked, flesh and skin	71.0	2.5	0.2	1.3	22.6	97	413	1.4	2.6	21.2	1.4	0.6	0.5	0.3	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	Potatoes, old, roasted, flesh only	64.9	N/A	5.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	Potatoes, old, potato wedges, with skin, dipped in sunflower oil	62.6	N/A	3.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	Potatoes, old, microwaved, flesh and skin	73.2	2.6	0.1	1.4	21.5	92	392	1.4	2.7	19.4	2.1	0.9	0.8	0.4	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	Potatoes, new, boiled, flesh and skin	81.5	1.8	0.6	1.1	14.9	68	291	0.9	1.8	13.8	1.1	0.5	0.4	0.2	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	Carrots, old, raw	89.0	0.5	0.4	0.6	7.7	34	146	2.1	3.9	0.1	7.2	1.1	1.1	5.0	<0.1	<0.1	0.3	0.10	0.11	0.01	0.07	0.08	<0.01	N/A
9	Carrots, old, boiled	90.0	0.5	0.5	0.5	N/A^	N/A^	N/A^	2.1	2.8	0.3	5.5	0.9	0.7	3.9	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10	Carrots, old, microwaved	87.5	0.6	0.2	0.7	N/A^	N/A^	N/A^	2.2	2.8	<0.1	7.2	1.1	1.1	5.0	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11	Onions, raw	89.1	1.0	0.1	0.4	8.0 <sup>+</sup>	35	150	1.1	2.2	N/A	6.2	2.3	1.8	2.1	<0.1	<0.1	1.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A

## Nutrient analysis of fruit and vegetables

Composite sample number	Sample description	Water g/100g	Protein g/100g	Total fat g/100g	Ash g/100g	Carbohydrate g/100g	Energy (kcal)/100g	Energy (kJ)/100g	Englyst fibre g/100g	AOAC fibre g/100g	Starch g/100g	Total sugars g/100g	Glucose g/100g	Fructose g/100g	Sucrose g/100g	Maltose g/100g	Lactose g/100g	Oligosaccharides g/100	Saturated fatty acids g/100g	Cis-monounsaturated fatty acids g/100g	Cis-n3 fatty acids g/100g	Cis-n6 fatty acids g/100g	Cis-polyunsaturated fatty acids g/100g	Trans fatty acids g/100g	Cholesterol milligrams/100g	
12	Onions, boiled	92.5	0.7	0.3	<0.1	N/A^	N/A^	N/A^	1.3	2.3	N/A	4.2	1.6	1.2	1.4	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13	Onions, fried	79.9	1.2	5.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
14	Broccoli (calabrese), raw	88.2	4.3	0.6	0.6	3.2	34	146	2.5	4.0	0.6	1.9	0.7	1.2	<0.1	<0.1	<0.1	0.7	0.15	0.06	0.17	0.08	0.25	<0.01	N/A	
15	Broccoli (calabrese), boiled	90.8	3.3	0.5	0.5	N/A^	N/A^	N/A^	2.3	2.8	0.7	1.6	0.8	0.8	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
16	Broccoli (calabrese), steamed	88.4	4.1	0.5	1.0	N/A^	N/A^	N/A^	2.6	3.8	0.8	2.0	0.8	0.9	0.3	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
17	Mushrooms, raw	92.9	1.0 <sup>#</sup>	0.2	0.7	0.3	7	29	1.2	0.7	<0.1	0.3	<0.1	0.3	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
18	Mushrooms, stewed	93.1	1.4 <sup>#</sup>	0.3	0.6	0.1	9	37	2.0	2.6	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
19	Mushrooms, cooked in sunflower oil	79.1	N/A	11.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
20	Sweetcorn, kernels, boiled 'on the cob'	76.0	3.6	1.9	0.8	9.5	67	284	2.6	5.1	6.8	2.5	2.4	0.1	<0.1	<0.1	<0.1	0.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
21	Cabbage, white, raw	90.1	1.2	0.1	0.7	4.8	24	101	2.0	3.0	<0.1	4.8	2.4	2.1	0.3	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
22	Cabbage, green, raw	88.4	2.4	0.2	0.8	4.1	27	114	2.7	4.1	<0.1	4.1	2.0	1.8	0.3	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
23	Cabbage, green, boiled	91.9	1.5	0.2	0.5	2.3	17	70	2.6	2.2	<0.1	2.3	1.0	0.9	0.4	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
24	Cauliflower, raw	91.1	2.5	0.4	0.7	4.4	30	128	1.8	1.8	0.2	2.9	1.2	1.3	0.4	<0.1	<0.1	1.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
25	Cauliflower, boiled	92.3	1.9	0.9	0.6	N/A^	N/A^	N/A^	1.6	1.9	<0.1	2.4	0.9	1.0	0.5	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
26	Beans, green, raw	91.3	2.1	0.4	0.7	3.1	24	102	2.5	3.4	1.0	2.2	0.8	1.4	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
27	Beans, green, boiled	89.6	2.1	0.3	0.8	4.0	26	108	2.5	4.1	0.9	3.0	1.3	1.2	0.5	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
28	Pak choi, steamed	94.8	1.5	0.1	0.7	1.9	14	58	N/A	2.0	0.4	1.5	0.8	0.6	0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

## Nutrient analysis of fruit and vegetables

Composite sample number	Sample description	Water g/100g	Protein g/100g	Total fat g/100g	Ash g/100g	Carbohydrate g/100g	Energy (kcal)/100g	Energy (kJ)/100g	Englyst fibre g/100g	AOAC fibre g/100g	Starch g/100g	Total sugars g/100g	Glucose g/100g	Fructose g/100g	Sucrose g/100g	Maltose g/100g	Lactose g/100g	Oligosaccharides g/100g	Saturated fatty acids g/100g	Cis-monounsaturated fatty acids g/100g	Cis-n3 fatty acids g/100g	Cis-n6 fatty acids g/100g	Cis-polyunsaturated fatty acids g/100g	Trans fatty acids g/100g	Cholesterol milligrams/100g
29	Tomatoes (standard), raw	94.6	0.5	0.1	0.4	3.0	14	61	1.0	1.0	<0.1	3.0	1.4	1.6	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
30	Tomatoes (standard), grilled, flesh and seeds only	93.3	0.6	0.2	0.6	3.4 <sup>+</sup>	17	72	1.0	<0.5	N/A	3.4	1.6	1.8	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
31	Tomatoes, cherry, raw	91.4	1.1	0.5	0.9	3.6 <sup>+</sup>	22	94	1.2	1.3	N/A	3.6	1.6	2.0	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32	Lettuce, average, raw	96.1	1.2	0.1	0.4	1.4 <sup>+</sup>	11	48	1.3	1.5	N/A	1.4	0.6	0.8	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
33	Spinach, baby, raw	93.5	2.6	0.6	2.0	0.2	16	69	1.2	1.0	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
34	Rocket, raw	93.1	3.6	0.4	1.5	<0.1 <sup>+</sup>	18	74	1.3	1.7	N/A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
35	Cucumber, flesh and skin, raw	96.5	1.0	0.6	0.4	1.2	14	60	0.7	0.7	<0.1	1.2	0.5	0.7	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
36	Peppers, red, raw	92.9	0.8	0.2	0.8	N/A <sup>^</sup>	N/A <sup>^</sup>	N/A <sup>^</sup>	1.0	2.2	<0.1	4.2	2.0	2.2	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
37	Peppers, red, boiled	93.3	0.8	0.1	0.5	N/A <sup>^</sup>	N/A <sup>^</sup>	N/A <sup>^</sup>	0.8	2.4	<0.1	3.3	1.2	1.9	0.2	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
38	Pepper, yellow, raw	92.8	0.8	0.2	0.6	N/A <sup>^</sup>	N/A <sup>^</sup>	N/A <sup>^</sup>	N/A	N/A	N/A	4.4	1.8	2.6	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
39	Bananas, raw, flesh only	75.0	1.2	0.1	1.1	20.3	81	348	0.8	1.4	2.2	18.1	7.9	7.5	2.7	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
40	Apples, eating, raw, flesh and skin	86.2	0.6	0.5	0.2	11.6 <sup>+</sup>	51	215	1.3	1.2	N/A	11.6	2.1	6.7	2.8	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
41	Apples, cooking, stewed, flesh only	87.3	0.2	0.3	0.2	9.7 <sup>+</sup>	40	169	1.3	1.7	N/A	9.7	2.1	5.9	1.7	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
42	Pears, raw, flesh and skin	85.2	0.3	0.1	0.2	10.9 <sup>+</sup>	43	182	1.6	2.7	N/A	10.9	3.1	6.6	1.2	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
43	Grapes, green, raw	82.7	0.7	0.2	0.5	15.2 <sup>+</sup>	62	263	0.7	1.2	N/A	15.2	7.3	7.9	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
44	Grapes, red, raw	81.1	0.6	0.1	0.5	17.0 <sup>+</sup>	67	286	0.6	1.3	N/A	17.0	7.7	9.3	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
45	Strawberries, raw	91.6	0.6	0.5	0.4	6.1 <sup>+</sup>	30	126	1.0	3.8	N/A	6.1	3.0	3.1	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

## Nutrient analysis of fruit and vegetables

Composite sample number	Sample description	Water g/100g	Protein g/100g	Total fat g/100g	Ash g/100g	Carbohydrate g/100g	Energy (kcal)/100g	Energy (kJ)/100g	Englyst fibre g/100g	AOAC fibre g/100g	Starch g/100g	Total sugars g/100g	Glucose g/100g	Fructose g/100g	Sucrose g/100g	Maltose g/100g	Lactose g/100g	Oligosaccharides g/100g	Saturated fatty acids g/100g	Cis-monounsaturated fatty acids g/100g	Cis-n3 fatty acids g/100g	Cis-n6 fatty acids g/100g	Cis-polyunsaturated fatty acids g/100g	Trans fatty acids g/100g	Cholesterol milligrams/100g
46	Blueberries, raw	85.7	0.9	0.2	0.2	9.1	40	169	1.5	1.5	<0.1	9.1	3.9	5.2	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
47	Citrus fruit, soft/easy peelers, flesh only	85.8	0.7	0.2	0.4	9.6*	41	173	1.2	1.5	N/A	9.6	1.6	1.9	6.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
48	Oranges, flesh only	87.0	0.8	0.2	0.4	8.2*	36	152	1.7	1.2	N/A	8.2	2.0	2.2	4.0	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
49	Melon, yellow flesh, flesh only	91.0	0.5	0.1	0.7	6.8*	29	122	0.4	0.7	N/A	6.8	1.7	2.5	2.6	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
50	Peas, frozen, raw	78.9	5.3	0.7	0.5	10.7	68	288	3.9	5.3	5.1	5.7	<0.1	<0.1	5.7	<0.1	<0.1	<0.1	0.13	0.07	0.06	0.31	0.36	<0.01	N/A
51	Peas, frozen, microwaved	77.6	5.7	0.9	0.6	10.8	71	303	4.5	5.6	4.2	6.6	<0.1	<0.1	6.6	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
52	Sweetcorn, canned in water, drained	78.7	2.6	1.7	0.5	N/A^	N/A^	N/A^	2.5	3.1	6.2	7.5	0.3	0.1	7.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
53	Tomatoes, canned, whole contents	92.9	1.1	0.1	0.7	3.8	19	80	0.7	0.8	<0.1	3.8	1.9	1.9	<0.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
54	Tomato puree	72.5	4.4	0.2	4.7	12.9	67	287	3.0	4.7	<0.1	12.9	5.5	7.4	<0.1	<0.1	<0.1	N/A	0.04	0.02	0.02	0.05	0.07	<0.01	N/A
55	Baked beans in tomato sauce	72.8	5.0	0.5	1.7	15.0	81	343	3.8	4.9	10.2	4.8	0.6	0.8	3.4	<0.1	<0.1	<0.1	0.09	0.06	0.15	0.13	0.27	<0.01	N/A
56	Potato products, shaped, frozen, baked	55.4	2.5	8.3	1.6	28.1	190	799	2.8	2.7	27.7	0.4	0.2	<0.1	0.2	<0.1	<0.1	N/A	0.89	3.30	0.18	3.47	3.65	0.02	N/A
57	Orange juice, chilled (premium and from concentrate)	87.7	0.9	<0.1	0.5	8.6*	36	153	0.2	<0.5	N/A	8.6	2.0	2.4	4.2	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
58	Orange juice, from concentrate, ambient	89.4	0.6	<0.1	0.3	8.5*	34	146	0.2	<0.5	N/A	8.5	2.0	2.4	4.1	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

## Nutrient analysis of fruit and vegetables

Composite sample number	Sample description	Water g/100g	Protein g/100g	Total fat g/100g	Ash g/100g	Carbohydrate g/100g	Energy (kcal)/100g	Energy (kJ)/100g	Englyst fibre g/100g	AOAC fibre g/100g	Starch g/100g	Total sugars g/100g	Glucose g/100g	Fructose g/100g	Sucrose g/100g	Maltose g/100g	Lactose g/100g	Oligosaccharides g/100g	Saturated fatty acids g/100g	Cis-monounsaturated fatty acids g/100g	Cis-n3 fatty acids g/100g	Cis-n6 fatty acids g/100g	Cis-polyunsaturated fatty acids g/100g	Trans fatty acids g/100g	Cholesterol milligrams/100g	
59	Apple juice, clear, from concentrate, ambient and chilled	86.6	0.1	<0.1	0.2	9.7*	37	157	N/A	N/A	N/A	9.7	2.4	5.5	1.8	<0.1	<0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

# Micronutrients

Composite sample number	Sample description	Vitamin A micrograms/100g*	Vitamin D micrograms/100g	Thiamin milligrams/100g	Riboflavin milligrams/100g	Niacin milligrams/100g	Tryptophan/60 milligrams/100g	Vitamin C milligrams/100g	Vitamin E milligrams/100g	Vitamin B <sub>6</sub> milligrams/100g	Vitamin B <sub>12</sub> micrograms/100g	Folate micrograms/100g	Pantothenic acid milligrams/100g	Biotin micrograms/100g	Sodium milligrams/100g	Potassium milligrams/100g	Calcium milligrams/100g	Magnesium milligrams/100g	Phosphorus milligrams/100g	Iron milligrams/100g	Copper milligrams/100g	Zinc milligrams/100g	Chloride milligrams/100g	Iodine micrograms/100g	Manganese milligrams/100g	Selenium micrograms/100g
1	Potatoes, old, raw, flesh only	<4	N/A	0.20	0.01	0.3	0.4	14	0.01	0.14	N/A	13	0.44	0.3	2	443	7	21	34	0.32	0.06	0.28	83	1	0.14	<0.5
2	Potatoes, old, boiled, flesh only	N/A	N/A	0.21	<0.01	0.5	0.4	9	0.01	0.06	N/A	18	0.43	0.3	1	365	6	18	31	0.34	0.06	0.24	74	N/A	0.12	<0.5
3	Potatoes, old, baked, flesh and skin	N/A	N/A	0.20	0.02	0.9	0.4	6	0.05	0.11	N/A	18	0.46	0.3	2	600	11	27	45	0.63	0.09	0.38	114	N/A	0.18	<0.5
4	Potatoes, old, roasted, flesh only	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	Potatoes, old, potato wedges, with skin, dipped in sunflower oil	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	Potatoes, old, microwaved, flesh and skin	N/A	N/A	0.23	0.01	0.8	0.4	5	0.13	0.14	N/A	33	0.48	0.3	2	585	13	27	43	0.75	0.09	0.36	121	N/A	0.18	<0.5
7	Potatoes, new, boiled, flesh and skin	N/A	N/A	0.13	0.01	0.7	0.4	7	0.11	0.13	N/A	21	0.51	0.3	3	377	11	18	44	0.61	0.08	0.23	88	<0.7	0.12	<0.5
8	Carrots, old, raw	1961	N/A	0.13	0.01	0.2	0.2	2	0.09	0.06	N/A	8	0.27	0.3	27	178	26	7	16	0.23	0.03	0.11	122	<0.7	0.07	<0.5
9	Carrots, old, boiled	1850	N/A	0.09	0.02	0.2	0.2	3	N/A	0.04	N/A	8	0.23	0.3	29	166	31	8	17	0.34	0.04	0.13	84	N/A	0.09	<0.5
10	Carrots, old, microwaved	1887	N/A	0.14	0.02	0.3	0.1	3	N/A	0.06	N/A	17	0.37	0.3	44	267	36	11	23	0.25	0.05	0.15	130	N/A	0.11	<0.5
11	Onions, raw	N/A	N/A	0.11	0.02	0.3	0.3	3	0.29	0.10	N/A	11	0.04	1.0	3	138	30	8	23	0.30	0.04	0.14	54	2	0.10	<0.5

## Nutrient analysis of fruit and vegetables

Composite sample number	Sample description	Vitamin A micrograms/100g*	Vitamin D micrograms/100g	Thiamin milligrams/100g	Riboflavin milligrams/100g	Niacin milligrams/100g	Tryptophan/60 milligrams/100g	Vitamin C milligrams/100g	Vitamin E milligrams/100g	Vitamin B <sub>6</sub> milligrams/100g	Vitamin B <sub>12</sub> micrograms/100g	Folate micrograms/100g	Pantothenic acid milligrams/100g	Biotin micrograms/100g	Sodium milligrams/100g	Potassium milligrams/100g	Calcium milligrams/100g	Magnesium milligrams/100g	Phosphorus milligrams/100g	Iron milligrams/100g	Copper milligrams/100g	Zinc milligrams/100g	Chloride milligrams/100g	Iodine micrograms/100g	Manganese milligrams/100g	Selenium micrograms/100g
12	Onions, boiled	N/A	N/A	0.03	<0.01	0.3	0.2	4	N/A	0.07	N/A	8	0.06	0.7	2	105	25	7	23	0.29	0.05	0.16	49	N/A	0.11	<0.5
13	Onions, fried	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
14	Broccoli (calabrese), raw	97	N/A	0.15	0.12	0.8	0.9	79	1.72	0.13	N/A	95	0.61	4.1	9	397	48	22	81	1.06	0.08	0.70	73	2	0.28	1
15	Broccoli (calabrese), boiled	100	N/A	0.04	0.06	0.5	0.9	44	1.67	0.11	N/A	34	0.28	3.5	6	212	35	14	59	0.60	0.05	0.40	50	N/A	0.20	1
16	Broccoli (calabrese), steamed	61	N/A	0.29	0.15	0.8	0.8	60	1.84	0.13	N/A	72	0.58	3.8	7	373	44	21	74	0.75	0.08	0.61	70	N/A	0.25	1
17	Mushrooms, raw	N/A	N/A	0.13	0.27	2.5	0.50	1	0.01	0.10	N/A	40	2.38	11.7	4	378	3	10	94	0.21	0.28	0.56	125	2	0.05	17
18	Mushrooms, stewed	N/A	N/A	0.09	0.26	1.8	0.8	<0.5	N/A	0.06	N/A	15	1.29	10.9	3	216	3	8	75	0.32	0.35	0.92	93	N/A	0.05	16
19	Mushrooms, cooked in sunflower oil	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
20	Sweetcorn, kernels, boiled 'on the cob'	5	N/A	0.25	0.08	2.2	0.7	4	0.42	0.02	N/A	24	0.40	1.0	<0.5	333	4	42	107	0.65	0.09	0.86	63	<0.7	0.32	1
21	Cabbage, white, raw	<4	N/A	0.23	0.02	0.3	0.1	47	0.05	0.12	N/A	84	0.21	0.1	7	227	56	12	26	0.39	0.03	0.16	94	2	0.12	1
22	Cabbage, green, raw	N/A	N/A	0.33	0.04	0.6	0.3	48	0.08	0.14	N/A	45	0.36	0.1	7	288	56	14	37	0.52	0.04	0.26	75	1	0.18	1
23	Cabbage, green, boiled	53	N/A	0.15	0.05	0.3	0.3	45	0.27	0.07	N/A	40	0.21	<0.1	5	187	54	9	29	0.40	0.03	0.16	79	N/A	0.12	1
24	Cauliflower, raw	<4	N/A	0.06	0.09	0.6	0.4	56	0.09	0.14	N/A	55	1.04	1.7	7	252	17	12	37	0.42	0.03	0.29	73	N/A	0.13	1
25	Cauliflower, boiled	<4	N/A	0.09	0.03	0.4	0.5	30	0.11	0.15	N/A	48	0.47	1.2	7	215	19	12	45	0.45	0.03	0.24	54	N/A	0.14	1

## Nutrient analysis of fruit and vegetables

Composite sample number	Sample description	Vitamin A micrograms/100g*	Vitamin D micrograms/100g	Thiamin milligrams/100g	Riboflavin milligrams/100g	Niacin milligrams/100g	Tryptophan/60 milligrams/100g	Vitamin C milligrams/100g	Vitamin E milligrams/100g	Vitamin B <sub>6</sub> milligrams/100g	Vitamin B <sub>12</sub> micrograms/100g	Folate micrograms/100g	Pantothenic acid milligrams/100g	Biotin micrograms/100g	Sodium milligrams/100g	Potassium milligrams/100g	Calcium milligrams/100g	Magnesium milligrams/100g	Phosphorus milligrams/100g	Iron milligrams/100g	Copper milligrams/100g	Zinc milligrams/100g	Chloride milligrams/100g	Iodine micrograms/100g	Manganese milligrams/100g	Selenium micrograms/100g
26	Beans, green, raw	42	N/A	0.12	0.09	0.8	0.4	8	0.44	0.06	N/A	58	0.11	1.0	<0.5	286	52	25	38	1.04	0.06	0.38	69	2	0.31	1
27	Beans, green, boiled	24	N/A	0.08	0.08	0.7	0.4	6	N/A	0.02	N/A	58	0.12	0.7	<0.5	304	61	28	44	1.06	0.12	0.38	54	N/A	0.37	1
28	Pak choi, steamed	55	N/A	0.07	0.04	0.5	0.3	15	0.40	0.04	N/A	80	0.14	1.0	39	287	73	16	47	0.96	0.06	0.40	129	1	0.27	0.4
29	Tomatoes (standard), raw	58	N/A	0.04	0.01	0.6	0.1	22	0.52	0.06	N/A	23	0.29	1.4	2	223	8	8	22	0.24	0.03	0.10	84	2	0.12	<0.5
30	Tomatoes (standard), grilled, flesh and seeds only	59	N/A	0.05	0.01	0.6	0.1	30	0.89	0.15	N/A	14	0.19	1.3	2	209	10	9	21	0.26	0.04	0.10	93	N/A	0.14	<0.5
31	Tomatoes, cherry, raw	80	N/A	0.05	0.02	0.4	0.1	15	0.89	0.06	N/A	24	0.19	1.8	4	274	10	12	31	0.34	0.05	0.16	95	2	0.12	<0.5
32	Lettuce, average, raw	10	N/A	0.14	0.05	0.5	0.1	1	0.64	0.02	N/A	60	0.19	0.7	9	222	24	9	22	0.13	0.03	0.22	78	1	0.14	<0.5
33	Spinach, baby, raw	260	N/A	0.09	0.18	1.0	0.7	29	0.48	0.12	N/A	161	0.28	0.1	30	682	119	80	44	1.89	0.16	0.90	112	4	0.86	5
34	Rocket, raw	190	N/A	0.19	0.18	0.7	0.9	20	0.22	0.08	N/A	88	0.29	1.3	30	326	216	28	44	1.26	0.19	0.40	93	5	0.41	2
35	Cucumber, flesh and skin, raw	12	N/A	0.03	0.02	0.2	0.1	2	0.04	0.01	N/A	14	0.32	0.8	4	156	21	10	23	0.30	0.03	0.10	67	3	0.09	<0.5
36	Peppers, red, raw	97	N/A	0.07	0.06	0.5	0.1	126	0.95	0.23	N/A	75	0.27	3.3	1	216	7	11	23	0.39	0.05	0.19	48	3	0.12	<0.5
37	Peppers, red, boiled	103	N/A	0.05	0.05	0.5	0.1	89	1.03	0.20	N/A	26	0.16	1.5	<0.5	159	7	10	20	0.35	0.05	0.19	29	N/A	0.12	<0.5
38	Pepper, yellow, raw	22	N/A	0.11	0.02	0.4	0.1	121	0.64	0.16	N/A	30	0.35	3.9	1	189	7	10	21	0.48	0.05	0.18	64	N/A	0.11	<0.5
39	Bananas, raw, flesh only	4	N/A	0.15	0.04	0.7	0.2	9	0.16	0.31	N/A	14	0.35	2.5	<0.5	330	6	27	23	0.27	0.10	0.18	109	3	0.36	<0.5

## Nutrient analysis of fruit and vegetables

Composite sample number	Sample description	Vitamin A micrograms/100g*	Vitamin D micrograms/100g	Thiamin milligrams/100g	Riboflavin milligrams/100g	Niacin milligrams/100g	Tryptophan/60 milligrams/100g	Vitamin C milligrams/100g	Vitamin E milligrams/100g	Vitamin B <sub>6</sub> milligrams/100g	Vitamin B <sub>12</sub> micrograms/100g	Folate micrograms/100g	Pantothenic acid milligrams/100g	Biotin micrograms/100g	Sodium milligrams/100g	Potassium milligrams/100g	Calcium milligrams/100g	Magnesium milligrams/100g	Phosphorus milligrams/100g	Iron milligrams/100g	Copper milligrams/100g	Zinc milligrams/100g	Chloride milligrams/100g	Iodine micrograms/100g	Manganese milligrams/100g	Selenium micrograms/100g
40	Apples, eating, raw, flesh and skin	2	N/A	0.04	0.04	0.1	<0.1	6	0.09	0.07	N/A	6	0.10	1.1	1	100	5	4	8	0.09	0.03	<0.06	44	4	0.04	<0.5
41	Apples, cooking, stewed, flesh only	<4	N/A	0.02	0.03	0.2	0.1	12	0.11	0.05	N/A	6	0.11	1.0	1	87	3	3	7	0.10	0.03	<0.06	73	4	0.02	<0.5
42	Pears, raw, flesh and skin	2	N/A	0.03	0.04	0.2	0.1	3	0.12	0.04	N/A	6	0.08	0.3	1	105	7	5	9	0.14	0.05	0.09	64	1	0.05	<0.5
43	Grapes, green, raw	<4	N/A	0.04	0.01	0.2	0.1	2	0.18	0.04	N/A	6	0.14	0.2	1	217	8.4	6.3	19	0.21	0.07	<0.06	44	1	0.06	<0.5
44	Grapes, red, raw	2	N/A	0.09	0.01	0.2	0.1	3	0.20	0.04	N/A	6	0.12	0.2	1	213	11	7	18	0.24	0.10	<0.06	63	N/A	0.06	<0.5
45	Strawberries, raw	<4	N/A	0.02	0.02	0.6	0.1	57	0.39	0.03	N/A	61	0.37	1.2	1	170	17	12	26	0.25	0.03	0.11	62	1	0.31	<0.5
46	Blueberries, raw	2	N/A	0.04	0.04	0.3	0.2	6	0.94	0.01	N/A	8	0.20	1.5	2	66	10	5	16	0.55	0.06	0.10	53	2	0.69	<0.5
47	Citrus fruit, soft/easy peelers, flesh only	18	N/A	0.17	0.03	0.4	0.1	42	0.21	0.06	N/A	19	0.15	1.4	1	128	25	9	15	0.09	0.04	<0.06	55	1	0.02	<0.5
48	Oranges, flesh only	9	N/A	0.22	0.03	0.5	0.1	52	0.35	0.05	N/A	33	0.27	1.0	1	122	24	8	16	0.11	0.03	<0.06	73	1	0.02	<0.5
49	Melon, yellow flesh, flesh only	1	N/A	0.07	0.01	0.4	0.1	8.0	0.07	0.07	N/A	13	0.24	2.6	11	180	6	6	6	0.18	0.02	0.10	97	<0.7	0.02	<0.5
50	Peas, frozen, raw	44	N/A	0.60	0.08	2.3	0.8	22	0.11	0.12	N/A	50	0.11	0.5	4	171	36	26	86	1.75	0.13	0.78	59	N/A	0.35	<0.5
51	Peas, frozen, microwaved	N/A	N/A	0.59	0.08	2.2	0.8	17	0.14	0.11	N/A	60	0.10	0.4	4	179	36	27	91	1.75	0.14	0.82	73	N/A	0.35	<0.5
52	Sweetcorn, canned in water, drained	7	N/A	0.26	0.06	1.9	0.4	24	0.63	0.13	N/A	45	0.12	1.1	1	158	3	16	52	0.34	0.04	0.37	84	<0.7	0.10	<0.5

## Nutrient analysis of fruit and vegetables

Composite sample number	Sample description	Vitamin A micrograms/100g*	Vitamin D micrograms/100g	Thiamin milligrams/100g	Riboflavin milligrams/100g	Niacin milligrams/100g	Tryptophan/60 milligrams/100g	Vitamin C milligrams/100g	Vitamin E milligrams/100g	Vitamin B <sub>6</sub> milligrams/100g	Vitamin B <sub>12</sub> micrograms/100g	Folate micrograms/100g	Pantothenic acid milligrams/100g	Biotin micrograms/100g	Sodium milligrams/100g	Potassium milligrams/100g	Calcium milligrams/100g	Magnesium milligrams/100g	Phosphorus milligrams/100g	Iron milligrams/100g	Copper milligrams/100g	Zinc milligrams/100g	Chloride milligrams/100g	Iodine micrograms/100g	Manganese milligrams/100g	Selenium micrograms/100g
53	Tomatoes, canned, whole contents	55	N/A	0.13	0.04	1.0	0.1	11	1.36	0.12	N/A	11	0.11	1.4	5	212	11	10	17	0.57	0.07	0.10	74	N/A	0.09	<0.5
54	Tomato puree	292	N/A	0.98	0.12	3.6	0.4	43	5.22	0.28	N/A	39	0.11	6.3	49	1257	45	57	94	1.45	0.41	0.56	297	N/A	0.34	1
55	Baked beans in tomato sauce	4	N/A	0.21	0.03	0.7	1.0	N/A	0.35	0.13	N/A	29	0.11	2.5	261	272	42	30	88	1.42	0.24	0.62	471	<0.7	0.33	3
56	Potato products, shaped, frozen, baked	N/A	N/A	0.19	0.02	0.8	0.5	44	2.70	0.10	N/A	17	0.29	0.8	254	423	29	22	55	0.74	0.13	0.41	423	N/A	0.16	<0.5
57	Orange juice, chilled (premium and from concentrate)	7	N/A	0.28	0.02	0.4	<0.1	40	0.15	0.06	N/A	22	0.15	0.7	1	158	8	9	15	0.07	0.03	<0.06	65	N/A	0.02	<0.5
58	Orange juice, from concentrate, ambient	N/A	N/A	0.33	0.02	0.4	0.1	31	N/A	0.04	N/A	32	0.19	0.7	3	164	12	10	16	0.07	0.03	0.07	70	1	0.03	<0.5
59	Apple juice, clear, from concentrate, ambient and chilled	N/A	N/A	0.05	0.02	0.2	<0.1	26	<0.01	0.05	N/A	1	0.05	0.9	3	89	6	4	6	0.06	0.01	<0.06	64	N/A	0.03	<0.5

\* Total vitamin A is calculated as retinol equivalents and is equal to retinol + (beta-carotene equivalents/6)

N/A = Not Analysed

< = Result was below the analytical limit of quantification (LOQ) or limit of detection (LOD). There is no distinction between '<' and 'not detected'

^ = Energy values and available carbohydrate have not been calculated because available carbohydrate may include small quantities of oligosaccharides that were not analysed in this sample

+ = Available carbohydrate calculated on the assumption that starch is not present

# = 60% of nitrogen in mushrooms is non-protein nitrogen. (Calculated as total nitrogen – non-protein nitrogen) X 6.25

## Annex D: Analytical methods used

### **Moisture:**

A homogenised portion of the sample is mixed with sand and heated to 102°C. The moisture loss is determined gravimetrically.

Accredited to BS/EN ISO/IEC 17025:2005. UKAS 0680

Ref: BS 4401 pt3:1997

LOQ 0.1 g/100g

### **Ash:**

A homogenised portion of the sample is ashed in a muffle furnace at 550°C. The ash is determined gravimetrically.

Accredited to BS/EN ISO/IEC 17025:2005. UKAS 0680

Ref: BS 4401 pt11:1998

LOQ 0.1 g/100g

### **Protein:**

The sample is analysed using Leco instrumentation following the Dumas procedure: The sample is combusted in an oxygen atmosphere, the gaseous product is cleaned and nitrogen compounds converted to nitrogen which is measured by a thermal conductivity cell. The crude protein is calculated by multiplying by the appropriate conversion factor.

Accredited to BS/EN ISO/IEC 17025:2005. UKAS 0680

LOQ 0.1 g/100g

### **Fat:**

The sample is acid hydrolysed with hydrochloric acid, cooled, filtered and dried. The fat is extract from the residue with petroleum ether and the dried fat determined gravimetrically.

Accredited to BS/EN ISO/IEC 17025:2005. UKAS 0680

Ref: BS 4401 pt4:1970 (Weibull Stoldt)

LOQ 0.1 g/100g

### **Fatty acids:**

The lipid fractions of the sample are solvent extracted. The isolated fat is transesterified with methanolic sodium methoxide to form fatty acid methyl esters (FAMES). The FAME profile is determined using capillary gas chromatography (GC). Quantification and identification of individual FAMES in the test material is achieved with reference to calibration standards.

Accredited to BS/EN ISO/IEC 17025:2005. UKAS 0680

LOQ 0.01 mg/100g

### **Sugars:**

The sugars are extracted with water, clarified and chromatographically separated on an amine column with an acetonitrile/water mobile phase. The sugars are detected using an evaporative light scattering detector and quantified with reference to calibration standards.

Accredited to BS/EN ISO/IEC 17025:2005. UKAS 0680

LOQ 0.1 g/100g

**Starch:**

The method consists of two separate determinations. The sample is treated with warm diluted hydrochloric acid, clarified and filtered; the optical rotation of the resulting solution is determined. In the second determination, the sample is extracted with 40% ethanol and filtered. The filtrate is acidified with hydrochloric acid, clarified and filtered again; the optical rotation of the resulting solution is determined at 20 ±2°C.

Accredited to BS/EN ISO/IEC 17025:2005. UKAS 0680

Ref: The Feeding Stuffs (Sampling and Analysis) Regulations 1982 Method 30a.

LOQ 2 g/100g

**Oligosaccharides:**

Malto-oligosaccharides (DP1-7) are determined individually by High Performance Anion Exchange Chromatography with Pulsed Amperometric Detection. In-house method

LOQ 0.1 g/100g

**Dietary Fibre:**

**AOAC:**

The sample is weighed and de-fatted if necessary. It is then gelatinised and treated with α-amylase and further digested enzymatically with protease and amyloglucosidase to remove the starch and protein. The dietary fibre is precipitated with IMS, filtered, washed, dried and weighed. Total dietary fibre is then determined gravimetrically and corrected for protein and ash.

Accredited to BS/EN ISO/IEC 17025:2005. UKAS 0680

Ref: AOAC 985.29/45.4.07 (2007)

LOQ 0.5 g/100g

**Englyst (Non-starch polysaccharides):**

Englyst Fibrezym kit with colorimetric end point

LOQ 0.2 g/100g

**Inorganics:**

**Sodium, Potassium, Calcium, Magnesium, Copper, Iron, Manganese, Zinc, Phosphorus, Selenium**

Samples are digested in acid under oxidising conditions, using sealed 'bombs' in automated microwave digestors, to prevent losses of volatile metals/inorganics, Metals (and some inorganics) are then determined by Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) or by Inductively Coupled Plasma Mass Spectrometry (ICP-MS). These techniques allow the sensitive and accurate (true and precise) determination of metals in foods and allow matrix interferences to be overcome.

In house methods - UKAS accredited.

**Iodide:**

Concentrations are determined by high resolution ICP-MS after extraction with tetra methyl ammonium hydroxide.

UKAS accredited.

**Chloride:**

Concentrations are determined using a Corning Chloride Analyser after extraction with nitric acid.

In house method FFF/B1-2104 - UKAS accredited.

**Vitamins – Water Soluble:**

**Thiamin, Riboflavin & Vitamin B6**

Thiamin, riboflavin and Vitamin B6 are determined by HPLC after appropriate and controlled acid and enzymatic hydrolysis. The methods are based on published CEN Standards. The selected method enables determination of total B6 as pyridoxine and is most appropriate to samples of this type where pyridoxine or its phosphate will form the major vitamin B6 component.

UKAS accredited.

**Niacin, Total Folate, Biotin, Pantothenic acid**

Determined using microbiological assay (MBA) procedures with detection carried out using VitaFast® MBA test kits.

UKAS accredited.

**Tryptophan**

Determined by HPLC using fluorescence detection after alkaline hydrolysis. Tryptophan contributes to the available Niacin on the basis that Niacin = Tryptophan/60.

**Vitamin B12**

Vitamin B12 is extracted from food by autoclaving in acetate buffer in the presence of cyanide. Vitamin B12 is determined by microbiological assay using *L.Delbrueckii.Lactis*.

UKAS accredited.

The B-vitamin results are expressed as follows:

Thiamin:	thiamin chloride hydrochloride
Riboflavin:	free riboflavin
Niacin:	nicotinic acid
Vitamin B6:	pyridoxine hydrochloride
Pantothenate:	pantothenic acid
Biotin:	d-biotin
B12:	cyanocobalamin
Total folate:	pteroylglutamic acid

**Vitamin C**

Vitamin C is determined by HPLC using fluorescence detection.

**Oil Soluble Vitamins:**

Vitamins A, E and the carotenoids are determined using an in house procedure involving saponification of the sample, solvent extraction and HPLC determination - UKAS accredited methods based on:

- Vitamin A – Retinol: BS EN 12823-1:2000. Foodstuffs-Determination of Vitamin A by High Performance Liquid Chromatography-Part 1: Measurement of Retinol.
- Vitamin A –  $\beta$ -Carotene: BS EN 12823-2:2000. Foodstuffs-Determination of Vitamin A by High Performance Liquid Chromatography-Part 2: Measurement of  $\beta$ -Carotene.

## Nutrient analysis of fruit and vegetables

- Vitamin E: BS EN 12822:2000. Foodstuffs-Determination of Vitamin E by High Performance Liquid Chromatography-Measurement of  $\alpha$ -,  $\beta$ -,  $\gamma$ - and  $\delta$ -tocopherols.

The total vitamin E figure takes into account the relative biological activities of the different isomers. Vitamin E is given as mg/100g of  $\alpha$  - tocopherol equivalent. The activities used for these calculations are as shown below:

$\alpha$ - tocopherol	1.0
$\beta$ - tocopherol	0.4
$\gamma$ - tocopherol	0.1
$\delta$ - tocopherol	0.01

Total vitamin A is expressed as ug/100g all-trans retinol equivalent (ATRE) and is calculated as follows:

All-trans retinol + (0.75\*13-cis retinol) + (  $\beta$ -carotene/6) + (other active carotenoids/12)

UKAS accredited.

Details of the quality control measures employed are given in the analytical report associated with this project, available at [www.dh.gov.uk/publications](http://www.dh.gov.uk/publications).

# References

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<sup>1</sup> Responsibility for nutrition policy in England transferred from the Food Standards Agency to the Department of Health (DH) on 1st October 2010. Management of the rolling programme of nutrient analysis has also transferred to DH

<sup>2</sup>Food Standards Agency. *Management of the Food Standards Agency programme of nutrient analysis and associated work*

<http://collections.europarchive.org/tna/20100907111047/http://food.gov.uk/science/dietarysurveys/analyticalsurveys/n10040/> (accessed 1 March 2013)

<sup>3</sup>Food Standards Agency. *McCance & Widdowson's The Composition of Foods integrated dataset*

<http://tna.europarchive.org/20110116113217/http://www.food.gov.uk/science/dietarysurveys/dietsurveys/> (accessed 1 March 2013)