Prepared for

Office of Nutrition
Bureau for Research and Development
U.S. Agency for International Development
Washington, D.C.
Contract No. DAN-5116-C-00-9114-00
Project No. 936-5116

THE CAROTENOID CONTENT OF FOODS WITH SPECIAL REFERENCE TO DEVELOPING COUNTRIES

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Edited and Produced by

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December 1993

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PREFACE

For a number of years, those involved with the food approach to combatting vitamin A deficiency in developing countries have been pressing for more information on the carotenoid content of foods This publication brings together data on as many different foods as possible as long as the data met minimum demands of quality It does not include data recently compiled by the Nutrient Composition Laboratory of the United States Department of Agriculture on foods consumed in the United States.

This report was reviewed at two meetings

* A special meeting held during the XV International Congress of Nutrition in Adelaide (Australia), 26 September - 1 October 1993,
* A workshop session of the meeting of the Eurofoods-Enfant Concerted Action Project within the framework of the FLAIR (Food-Linked Agro-Industrial Research) Programme of the Commission of the European Communities held in Algarve (Portugal), 10-13 November 1993

In the light of comments and new data received, the manuscript was revised in the period October-December 1993 Data received before 30 November was considered for inclusion in the database

We wish to thank Dr Frances Davidson, Deputy Director of the Office of Nutrition of the Research and Development Bureau of the U.S. Agency for International Development (USAID R&D/N), and Mr Robert Pratt and Ms Mary Linehan who are responsible for managing the Vitamin A Field Report Project (VITAL) of USAID R&D/N at the International Science and Technology Institute Inc for their help, advice and support throughout the project We wish to express our gratitude to all of those people who supplied data and/or suggested amendments to the manuscript In particular we would like to thank Dr Gary Beecher and Ms Joanne Holden of the U S Department of Agriculture Nutrient Composition Laboratory (Beltsville, MD) for providing further information on the CAREX expert system for evaluating carotenoid data, Professor David Southgate formerly of the Agricultural and Food Research Council Institute of Food Research in Norwich (U.K) for his advice in applying the system to the types of data encountered, Dr John Klensin of the INFOODS Secretariate in Boston (U S A) for assistance in designing the database, and Ms Esther Reichman and Mrs Lous Duym in Wageningen for assistance in entering the data and for secretarial support

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Wageningen, December 1993

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1. INTRODUCTION

Up until now, programs to combat vitamin A deficiency have been directed largely towards the use of vitamin A supplements and much less effort has been directed towards using locally available foods Most people agree that the use of such foods is the method of choice for combatting vitamin A deficiency in the long term The reasons for this are that people can use resources available locally, and that increasing intake of vitamin A-rich and provitamin A-rich foods will also increase the intake of other nutrients Neither of these conditions can be met by the use of synthetic preparations of vitamin A provided either as a vitamin A preparation per se or in fortified foods

One of the limitations to developing strategies and designing programs for controlling vitamin A deficiency using local foods, and for evaluating such endeavours has been the lack of reliable information on the provitamin A carotenoid content of foods In addition to having such information it is essential that, in the future, more attention should be directed towards the problem of carotenoid bioavailability as it is known that bioavailability can be reduced markedly by the matrix in which carotenoids are found, the fat intake of individuals, and the nature and degree of intestinal parasitism Another limitation to developing strategies and designing programs is the lack of understanding of the factors influencing food habits with respect to the intake of foods rich in vitamin A and provitamin A carotenoids When more information is available on present and realistic future intake of vitamin A and carotenes corrected for their bioavailability, it will be possible to determine to what extent other measures will need to be taken to increase vitamin A intake of particular groups of various populations

In recent years, much progress has been made in the development of methodology for quantifying the content of individual carotenoids in foods based on high performance liquid chromatography (HPLC) Initially foods were first analyzed by measuring the extinction of extracts of foods This method gave an overestimate of the provitamin A content of foods as simple extracts also contain carotenoids which are incapable of being converted to vitamin A It is possible to separate various classes of carotenoids from the provitamin A carotenoids, particularly those containing oxygen by open column chromatography, and then to measure the extinction of the provitamin A-carotenoid fraction This method has proved very useful in providing information on the provitamin A content of foods However, when the necessary infrastructure and equipment are available, HPLC is the method of choice since it provides data on individual carotenoids This allows specific conversion factors for each carotenoid to be applied for the calculation of vitamin A activity It is also now realized that carotenoids have activity independent of that derived by their conversion to vitamin A. This activity is attributed largely, but not exclusively, to their ability to serve as antioxidants

Recently, a compilation of data on the carotenoid content of foods consumed in the United States has been prepared by the Food Composition Laboratory of the United States Department of Agriculture in collaboration with the National Cancer Institute (97). In the article presenting the data, a carotene data expert system (CAREX) was

presented which enables data on the carotenoid content of foods derived by using HPLC to be evaluated The present work does not include data from this earlier paper but has examined data from other sources with special emphasis being given to data for foods from developing countries It has also used CAREX as the basis for the evaluation of data Since the system is based on data available on US foods, the criteria can afford to be somewhat strict but there are very few data for foods from developing countries which meet even the minimal standards of the CAREX system. Therefore in the present work, criteria for inclusion were relaxed but the quality of the data is indicated.

2. METHODS

Identification of resource persons and of data

The first step in the process of collecting data was to identify people engaged now or in the past on analyzing carotenoids in foods, especially from developing countries This was done by searching the literature, examining proceedings of past meetings of the International Vitamin A Consultative Group and of relevant projects of the Commission of the European Communities (CEC), and through personal contacts

A letter requesting that information on the carotenoid content of foods be returned to the Project Office was sent to about 110 people throughout the world After follow-up and the meetings at which the draft was reviewed, 78 responses were received

In addition, a search of the literature was undertaken with particular attention being given to the following sources

* Scientific literature with special reference to the following key journals Food Chemistry, International Journal of Food Science and Technology, Journal of Agricultural and Food Chemistry, Journal of Chromatography, Journal of Food Science, Journal of Liquid Chromatography, Journal of Food Composition and Analysis, Journal of Micronutrient Analysis, Journal of Food Quality, and Journal of the Science of Food and Agriculture

* The following electronic databases Medline, Commonwealth Agricultural Bureaux (CAB), Current Contents and the Agris system of the Dutch Ministry of Agriculture, Fisheries and Nature Management

* National and regional food composition tables including the regional databases of INFOODS

* Newsletters, minutes of meetings, leaflets and other grey literature of organizations and institutes interested in the carotenoid content of foods including Vitamin A Sieve, Xerophthalmia Club Bulletin, Carotenoid News, VitAl News and Vitamin A News Notes

Assistance in finding and interpreting information was readily provided by many people in Wageningen which proved to be a very suitable place to carry out this task. Wageningen Agriculture University constitutes the only Faculty of Agriculture in the Netherlands and Wageningen is the home of more than half of the Dutch research institutes related to agriculture Practically all of the departments of the University and the research institutes have strong links with developing countries For example, the Department of Agronomy of the University is the co-ordinating centre for the Plant Resources of Southeast Asia (PROSEA) project which aims at describing all of the plant resources in the region In addition, many people in Wageningen are involved in international organizations and cooperative projects including those funded by the Commission of the European Communities

Data reported in existing food composition tables were carefully examined as they are often not original analytical values but imputed, calculated or borrowed from other sources This is particularly so for data in tables from developing countries Only original analytical values and values calculated from these were considered acceptable for inclusion in the database Where possible, borrowed values were traced back to their source and, if appropriate, included However, many tables do not provide adequate reference to the source of data A visit was made to the Nutrition Section of the Ministry of Agriculture, Fisheries and Food in London in order to determine those values in the United Kingdom food composition tables which were derived from analyses by the UK Laboratory of the Government Chemist For other data, where information in the published or unpublished material was limited, authors were asked to provide additional details, usually on the analytical method used

Criteria for inclusion of data

As already stated in the Introduction, data presented in the recent publication from the USDA Nutrient Composition Laboratory database (97) was not considered for inclusion as this would result in unnecessary duplication of effort even though some data from developing countries is included in that database (for example reference 99) From the work undertaken, data were selected from 71 published and 15 unpublished sources (see Chapters 3 and 7)

Most attention has been given to the carotenoid content of vegetables and fruits In addition, there is some data for meat, fish, fats, eggs, cereals and dairy products.

Since some of the variation in the reported composition of foods may be attributable to such factors as variety, growing conditions and time of harvest, data have not been aggregated to any great extent It is thought that this would make the database more useful to investigators throughout the world Where data have been aggregated (for example, for different varieties or times of harvest), this has been denoted in the database and in the table presented in Chapter 3 Data for cooked foods have been included when they meet the evaluation criteria

Data evaluation

In order to evaluate the quality of the data reported in publications, it is necessary to establish criteria Data quality depends to a large extent on sampling procedures and analytical methodology Over the last two decades with the introduction of high-performance liquid chromatography (HPLC), it has become easier to identify and quantify many analytes including carotenoids However, equipment, reagents and maintenance are often too costly and too difficult to arrange for many laboratories in developing countries Thus other methods such as spectrophotometry often combined with open column chromatography (OCC) and are still commonly used in many countries for analyzing the carotenoid content of foods

The data collected have been evaluated with respect to sampling procedures, number of samples analyzed, analytical method and method validation For this purpose, the following classification system has been established:

H. HPLC data
R. OCC data
O. Other data

A further classification was made as follows:

a/b/c data classified according to the CAREX system (a, b, and c ratings, see below)
k data for which adequate procedures appear to have been followed but detailed information was not available for each step of the method
n data for which documentation is insufficient to allow proper evaluation
z data of poor quality

For example, HPLC data for which no documentation is available is given a 'Hn' rating.

The CAREX expert system (97) was developed to evaluate data for the carotenoid content of food in five general categories number of samples, analytical method, sample handling, sampling plan and analytical quality control. Data considered acceptable by this system represent the highest quality information on carotenoids. CAREX quality ratings assume that HPLC is used and depend on sampling procedures, analytical method, the extent to which external standards are used, the extent to which procedures are documented, and emphasizes how representative the carotenoid values are for US foods Data acceptable to the CAREX system are classified as 'a', 'b' or 'c' but much of the data evaluated which gained a CAREX rating were classified in 'c' which is the lowest class

Much of the data included in the data base were found to be not acceptable by the criteria of the CAREX system because of the lack of sufficient documentation. However, such data can still be useful, especially when no other data are available. Therefore, data which lack full details on sampling, analytical and validation procedures were classified as 'k'

Data for which there was little or no description of sampling procedures or analytical methods were classified in the 'n' category Data derived using methods regarded as unsatisfactory are classified as 'z' Such data include those derived using spectrophotometry without prior separation by open-column chromatography because the values so obtained are inflated by the inclusion of carotenoids which are not precursors of vitamin A

In the data presented in Chapter 3, the principle method used is given together with the data quality rating. Reference to the extraction and chromatographic procedures are also included. A summary of the methods used is provided in Chapter 4 while the references to the data and to the methods used are given in Chapter 7

Development of database files
It is essential that all information, which is received and found relevant, is entered into a database structure This allows for easy search and retrieval operations and permits the data to be manipulated and presented according to user's needs.

The database management system dBASE IV version 1 5 was used to capture the data The advantages of this software package are its wide-spread use and availability, established import and export features for data exchange with other software, and ability to manipulate related data files A true relational database management system does have some advantages over dBASE IV in terms of the number of variables and the ability of relating variables to one another However, for the present purpose, the features of dBASE IV were regarded as sufficient

The data have been entered into three files differing in structure and content, and referred to as **food.dbf, method.dbf and data.dbf** (see Appendix 2 for structure of the files)

* The file **food.dbf** contains information on the names, origin and description of foods The multi-faceted description ensures that each food is uniquely identified

* The file **method.dbf** describes the methods used for the identification and quantification of the carotenoids for each food It contains information on procedures for extraction, saponification, chromatography and analytical quality control Modifications of established analytical procedures are flagged and specified

* The file **data.dbf** contains the data for each carotenoid for all foods. For practical reasons, it includes some of the information already present in the food dbf file

The food dbf and data dbf files are linked by a number (**foodnr**) that uniquely identifies each food in these files A second link is created by the reference number (**refnr**) in the data dbf and method dbf files. Using these two link fields, the information from the three data files can be combined to produce custom databases The selection and presentation of the data in Chapter 3 is described in Appendix 3.

Initially, references to sources of the data were also entered in dBASE However, since the program has only limited ability to produce various characters on both screen and paper, the references (Chapter 7) were entered in WordPerfect format.

3. TABLE OF THE CAROTENOID CONTENT OF FOODS

Introductory notes

i. Grouping of foods

- Foods included in this table are listed according to the following food groups cereals, dairy products, eggs, fats, fish, fruit, meat, oils and vegetables. This grouping is based on the Eurocode food classification system The term cereal has been used for grain and grain products and the term dairy products for milk and milk products

- Within each food group, foods are listed alphabetically in English with their scientific names In most cases, the classification extends to genus and species and, where possible, foods are classified to subspecies or variety

- For some foods, the English name was not known and was replaced by either a transliteration or the local name.

ii. Missing information

- Missing entries in a particular column indicate that no information was available in the original article. Thus such values should not be considered as zero.

iii. Expression of data

- Data are expressed as μg per 100g edible portion, and values in other units were re-calculated to this method of presentation This resulted in a lower number of significant digits for these foods In most cases, the standard deviations or ranges were used as measure of variability.

- Where the number of analyses (n) was available, standard errors were transformed into standard deviations ($SD = SE \times \sqrt{n}$) Values expressed as dry weight, for which no data on moisture content were available, were excluded Some of the minimum and maximum values reported in the table do not necessarily represent the actual values originally reported but are minima and maxima of aggregated means.

- Retinol equivalents were calculated using the conversion factors from the paper by Underwood (100) Data for total carotenoid values were not calculated from the individual carotenoids but were listed as such in the publication

- The data derived from reference 70 usually are usually comprised of mean values of data for foods from several Chinese provinces or cities.

iv. Abbreviations and symbols

The following abbreviations and symbols are used in the tables

EP	Edible portion of the food (if given)
Mst	Moisture content of the food (if given)
α-carot	α-Carotene
ß-carot	ß-Carotene
ß-crypto	ß-Cryptoxanthin
Zeaxanth	Zeaxanthin
RE	Retinol equivalents
Princ method	Principal analytical method
HPLC	High-performance liquid chromatography
OCC	Open column chromatography
Ext.ref.	Reference to extraction method
Chr ref.	Reference to chromatographic method
Ref	Reference number to the original publication in Chapter 7
QM	Quality measure
NA	Not analyzed
ND	Not determined
tr	Trace values

[a]	ß-cryptoxanthin based on cryptoxanthin values
[b]	ß-cryptoxanthin = free cryptoxanthin
[c]	Estimated from figure
[d]	Average of values for wild and cultivated varieties
[e]	Average of two cooking methods
[f]	Boiled in salted water
[g]	Boiled in unsalted water
[p]	Impossible to calculate from data provided

CEREALS

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
85	Cake, sponge (Croatia) ()										250	[p]	OCC	85	85	Rn
85	Cookies (Croatia) ()										360	[p]	OCC	85	85	Rn
7	Cornflakes (Malaysia) (Zea mays)					52						9	HPLC	71.1	06	Hk
85	Maize flour (Croatia) (Zea mays)										2150	[p]	OCC	85	85	Rn
85	Maize grits , instant (Croatia) (Zea mays)										2550	[p]	OCC	85	85	Rn
85	Soya bean flour , defatted (Croatia) (Glycine soja)										220	[p]	OCC	85	85	Rn
85	Wheat germ (Croatia) (Triticum aestivum)										280	[p]	OCC	85	85	Rn
7	Wheat infant cereal (Malaysia) (Triticum aestivum)					20						3	HPLC	71 1	06	Hk

DAIRY PRODUCTS

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
7	Butter (Malaysia) ()					675						113	HPLC	71 1	06	Hk
7	Cheese (Malaysia) ()					221						37	HPLC	71 1	06	Hk
7	Full cream milk powder (Malaysia) ()					137						23	HPLC	71.1	06	Hk
7	Ghee (Malaysia) ()					549						92	HPLC	71.1	06	Hk
75	Icecream (Croatia) ()										50	[p]	OCC	85	85	Rn
7	Malted milk powder (Malaysia) ()					8						1	HPLC	71 1	06	Hk
7	Margarine (Malaysia) ()					897						150	HPLC	71 1	06	Hk
62	Milk, human human, first morning (USA) ()		100		3	5		12	4			1	HPLC	62	62	Hk
	Sweet condensed milk filled (Malaysia) ()					6						1	HPLC	71.1	06	Hk
7	Sweetened condensed milk (Malaysia) ()					53						9	HPLC	71 1	06	Hk
7	Ultra-heat-treated milk (Malaysia) ()					20						3	HPLC	71.1	06	Hk
91	Whipping cream (Netherlands) ()					200						33	HPLC	91	91	Hc

EGGS

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr ref	QM
7	Egg hen (Malaysia) ()					1						0	HPLC	71.1	06	Hk
7	Egg salted (Malaysia) ()					10						2	HPLC	71 1	06	Hk
7	Egg quail (Malaysia) ()					5						1	HPLC	71.1	06	Hk
7	Egg duck (Malaysia) ()					32						5	HPLC	71.1	06	Hk
7	Egg century (Malaysia) ()					4						1	HPLC	71 1	06	Hk
85	Egg (Croatia) ()										40	[p]	OCC	85	85	Rn

FATS

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref	Chr. ref.	QM
85	Margarine, soft (veg. oil) (Croatia) ()										430	[p]	OCC	85	85	Rn
85	Margarine (Croatia) ()										230	[p]	OCC	85	85	Rn
85	Margarine, 'Delicates' (Croatia) ()										500	[p]	OCC	85	85	Rn
91	Mayonnaise (Netherlands) ()					42						7	HPLC	91	91	Hc

FISH

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr. ref.	QM
7	Anchovies (Malaysia) (Engraulis sp.)					6						1	HPLC	71 1	06	Hk
7	Black pomfret (Malaysia) ()					0						0	HPLC	71.1	06	Hk
7	Cockles (Malaysia) (Cardium edule)					194						32	HPLC	71 1	06	Hk
7	Crab meat (Malaysia) (Cancer pagurus)					44						7	HPLC	71.1	06	Hk
7	Cuttlefish (Malaysia) (Sepia officinalis)					0						0	HPLC	71.1	06	Hk
7	Cuttlefish, dried (Malaysia) (Sepia officinalis)					1						0	HPLC	71.1	06	Hk
7	Indian mackerel (Malaysia) (Scomber sp)					0						0	HPLC	71.1	06	Hk
7	Lobster (Malaysia) (Homarus vulgaris)					149						25	HPLC	71 1	06	Hk
7	Oyster, dried (Malaysia) (Ostrea edulis)					138						23	HPLC	71.1	06	Hk
91	Plaice, fried (Netherlands) (Pleuronectes platessa)					0						0	HPLC	91	91	Hc
7	Prawn, dried (Malaysia) (Palaemon serratus)					34						6	HPLC	71 1	06	Hk
7	Prawn, pink (Malaysia) (Palaemon sp.)					50						8	HPLC	71.1	06	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
7	Sardine, canned (Malaysia) (Clupea pilchardus)					62						10	HPLC	71.1	06	Hk
7	Scallop (Malaysia) (Chlamys opercularis)					39						7	HPLC	71.1	06	Hk
7	Shrimp paste (Malaysia) ()					8						1	HPLC	71.1	06	Hk
7	Shrimp, fermented (Malaysia) (Crangon crangon)					0						0	HPLC	71.1	06	Hk
7	Spanish mackerel (Malaysia) (Scomber sp.)					0						0	HPLC	71.1	06	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
91	Appels, peeled (Netherlands) (Pyrus malus)					21						4	HPLC	91	91	Hc
91	Appel, with peel (Netherlands) (Pyrus malus)					0						0	HPLC	91	91	Hc
27	Apple, raw (Spain) (Pyrus malus)	fruit, peeled (ripe)	80	85.9		20	8	6		1		4	HPLC	74	01 2	Hc
55	Apple, fresh Delicious (Australia) (Pyrus malus)	skin plus corte	92	82.0	0	10	10 [a]					3	OCC	72.1	72.1	Rk
55	Apple, fresh Golden Delicious (Australia) (Pyrus malus)	skin plus corte	91	84.3	0	10	10					3	OCC	72.1	72.1	Rk
55	Apple, fresh Jonathan (Australia) (Pyrus malus)	skin plus corte	91	83 0	0	0	10					1	OCC	72.1	72.1	Rk
55	Apple, fresh Granny Smith (Australia) (Pyrus malus)	skin plus corte	92	84.4	0	0	10					1	OCC	72.1	72.1	Rk
70	Apple, raw (China) (Malus spp)		83	85.3							60 (40-80)	0	OCC	70	70	Rn
84	Apple, raw , winter (CIS) (Malus spp)										30	[p]	unknown	84	84	-
84	Apple, canned, drained (CIS) (Malus spp.)										20	[p]	unknown	84	84	-
84	Apple (CIS) (Malus spp.)	juice/jam									0	[p]	unknown	84	84	
84	Apple, raw , summer (CIS) (Malus spp.)										20	[p]	unknown	84	84	-

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
87	Apple, raw , Gala (New Zealand) (Malus sylvestris)		93	85.8	0	65						11	HPLC	87	87	Hn
87	Apple, raw , Golden Delicious (New Zealand) (Malus sylvestris)			84.9	0	54						9	HPLC	87	87	Hn
87	Apple, raw , dessert (New Zealand) (Malus sylvestris)	flesh			0	44						7	HPLC	87	87	Hn
87	Apple, raw (New Zealand) (Malus sylvestris)			84.4	0	44						7	HPLC	87	87	Hn
87	Apple, raw , Delicious (New Zealand) (Malus sylvestris)		93	84.3	0	43						7	HPLC	87	87	Hn
87	Apple, raw , Sturmer (New Zealand) (Malus sylvestris)		94	83.1	0	36						6	HPLC	87	87	Hn
87	Apple, baked , cooking (New Zealand) (Malus sylvestris)					41						7	HPLC	87	87	Hn
87	Apple, raw , Granny Smith (New Zealand) (Malus sylvestris)			85.8	0	28						5	HPLC	87	87	Hn
87	Apple, baked , cooking (New Zealand) (Malus sylvestris)					47						8	HPLC	87	87	Hn
87	Apple, raw , Jonathan (New Zealand) (Malus sylvestris)			83.9	0	44						7	HPLC	87	87	Hn
87	Apple, raw , Red Delicious (New Zealand) (Malus sylvestris)		94	83.3	0	45						8	HPLC	87	87	Hn
87	Apple, raw , Dunn's favourite (New Zealand) (Malus sylvestris)		85	85.5	0	44						7	HPLC	87	87	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
87	Apple, raw , Gravenstein (New Zealand) (Malus sylvestris)			84.6	0	44						7	HPLC	87	87	Hn
87	Apple, raw , Kidd's Orange (New Zealand) (Malus sylvestris)		85	86.0	0	44						7	HPLC	87	87	Hn
87	Apple, raw , cooking (New Zealand) (Malus sylvestris)	flesh			0	44						7	HPLC	87	87	Hn
87	Apple, stewed , cooking (New Zealand) (Malus sylvestris)					36						6	HPLC	87	87	Hn
87	Apple, stewed , cooking (New Zealand) (Malus sylvestris)					39						7	HPLC	87	87	Hn
87	Apple, raw , Cox's orange (New Zealand) (Malus sylvestris)		89	82.5	0	41						7	HPLC	87	87	Hn
70	Apple, paradise, raw 'fragrant fruit' var. (China) (Malus pumila dulcisima)		78	86.4							0	0	OCC	70	70	Rn
36	Apricot, raw (USA) (Prunus armeniacea)	fruit (ripe)				3370						552	HPLC	36	36	Hk
26	Apricot, raw (Egypt) (Prunus armeniacea)				0	1581						264	HPLC	74	74	Hk
27	Apricot, raw (Spain) (Prunus armeniacea)	fruit, no stone (ripe)	93	85.3		140	28	tr	tr	tr		26	HPLC	74	01 2	Hc
47	Apricot (Vietnam) (Prunus armeniacea)										1900	[p]	HPLC/OCC	71	71	Hn
60	Apricot, fresh Trevatt (Australia) (Prunus armenicacea)		93	85.6		110					617	[p]	OCC	72.1	72.1	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr ref.	QM
60	Apricot, fresh Bavinity (Australia) (Prunus armenicacea)		95	85.3	7	285					617	[p]	OCC	72.1	72.1	Rk
70	Apricot, raw (China) (Prunus armeniaca)		90	85.0							1790	0	OCC	70	70	Rn
84	Apricot, stewed (CIS) (Prunus armeniaca)										1300	[p]	unknown	84	84	-
84	Apricot (CIS) (Prunus armeniaca)	juice									1300	[p]	unknown	84	84	-
84	Apricot, canned, drained (CIS) (Prunus armeniaca)										3500	[p]	unknown	84	84	-
84	Apricot, raw (CIS) (Prunus armeniaca)										1600	[p]	unknown	84	84	-
84	Apricot (CIS) (Prunus armeniaca)	jam									300	[p]	unknown	84	84	-
85	Apricot , 'cocktail' (Croatia) (Prunus armeniaca)										760	[p]	OCC	85	85	Rn
87	Apricot, raw , Moorpark (New Zealand) (Prunus armeniaca)		94	86.2	0	6939						1157	HPLC	87	87	Hn
87	Apricot, dried (New Zealand) (Prunus armeniaca)					8227						1371	HPLC	87	87	Hn
87	Apricot, dried, stewed (New Zealand) (Prunus armeniaca)					3253						542	HPLC	87	87	Hn
87	Apricot, raw , Sundrop (New Zealand) (Prunus armeniaca)		95	87.0	0	4974						829	HPLC	87	87	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr. ref.	QM
87	Apricot, canned (New Zealand) (Prunus armeniaca)					1974						329	HPLC	87	87	Hn
87	Apricot, stewed (New Zealand) (Prunus armeniaca)					1395						233	HPLC	87	87	Hn
87	Apricot, stewed (New Zealand) (Prunus armeniaca)					1338						223	HPLC	87	87	Hn
87	Apricot, raw , Steven's Favourite (New Zealand) (Prunus armeniaca)		96	85.1	0	3426						571	HPLC	87	87	Hn
87	Apricot, raw (New Zealand) (Prunus armeniaca)		95	86.1	0	5166						861	HPLC	87	87	Hn
87	Apricot, dried, stewed (New Zealand) (Prunus armeniaca)					3380						563	HPLC	87	87	Hn
88	Apricot, raw (Slovak republic) (Prunus aremeniacea)					1850 (1360-2520)					3090 (2260-4380)	[p]	OCC	88	88	Rz
15	Apricots, canned in syru (U K) (Prunus armeniaca)	flesh	100	80.0	3	150	0					25	HPLC	77	77	Hk
15	Apricots, dried (U K) (Prunus armeniaca)	flesh	100	14.7	9	640	0					107	HPLC	77	77	Hk
15	Apricots, dried, stewed (U K) (Prunus armeniaca)	flesh	100	61.8	3	260	0					44	HPLC	77	77	Hk
84	Apricots, dried (CIS) (Prunus armeniaca)										1000	[p]	unknown	84	84	-
70	Apricot, dried, raw (China) (Prunus armeniaca)		100	23.7							280 (210-340)	0	OCC	70	70	Rn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr. ref.	QM
84	Ashberry, raw (CIS) ()										9000	[p]	unknown	84	84	-
84	Ashberry, black (CIS) ()	juice									0	[p]	unknown	84	84	-
84	Ashberry, black, raw (CIS) ()										1200	[p]	unknown	84	84	-
45	Asian pear, raw (Japan) (Pyrus pyrifolia)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
45	Asian pear, raw (Japan) (Pyrus pyrifolia)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
45	Atemoya, raw (USA) (Annona squamosa)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
45	Atemoya, raw (USA) (Annona cherimola)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
15	Avocado Fuerte var (U K) (Persea americana)	flesh	100	73.1	3	14	tr					3	HPLC	77	77	Hk
15	Avocado Hass var. (U K) (Persea americana)	flesh	100	72.0	3	14	tr					3	HPLC	77	77	Hk
45	Avocado, raw variety II (USA) (Persea americana)	fruit			36	42	22					12	HPLC	45	45	Hk
45	Avocado, raw variety I (USA) (Persea americana)	fruit			41	68	16					16	HPLC	45	45	Hk
45	Avocado, raw variety II (USA) (Persea americana)	fruit			20	63	78					19	HPLC	45	45	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr ref.	QM
45	Avocado, raw variety I (USA) (Persea americana)	fruit			16	38	27					10	HPLC	45	45	Hk
47	Avocado (Vietnam) (Persea americana)										37u	[p]	HPLC/OCC	71	71	Hn
56	Avocado, fresh Fuerte (Australia) (Persea americana)	pulp	76	71.2	360	20	290 [a]					61	OCC	72.1	72 1	Rk
56	Avocado, fresh Hass (Australia) (Persea americana)	pulp	70	74.4	290	30	160 [a]					45	OCC	72.1	72.1	Rk
87	Avocado, raw , Hass (New Zealand) (Persea americana)			62.7	0	130						22	HPLC	87	87	Hn
96	Avocado, raw (Australia) (Persea americana)				320	26	215					52	HPLC	96	96	Hn
15	Avocado, average (U K) (Persea americana)	flesh	100	72.5	4	14	tr					3	HPLC	77	77	Hk
56	Babaco, fresh (Australia) (Carica pentagona)	pulp	98	93.9	10	160	20					29	OCC	72.1	72 1	Rk
87	Babacos, raw (New Zealand) (Carica pentagona)		95	93.2	11	100	22					20	HPLC	87	87	Hn
67	Balsam pear, fresh (USA) (Momordica charantia)	flesh (immature)			220	150		240				44	OCC	67	67	Rk
67	Balsam pear, fresh (USA) (Momordica charantia)	flesh (mature)			150	230		100	tr			51	OCC	67	67	Rk
6	Banana variety 2 (Malaysia) (Musa sapientum)	fruit (mature)			157	92	0	37	0			29	HPLC	71.1	06	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr. ref.	QM
6	Banana variety 1 (Malaysia) (Musa sapientum)	fruit (mature)			62	40	0	27	0			12	HPLC	71.1	06	Hk
27	Banana, raw (Spain) (Musa paradisiaca)	fruit, peeled (ripe)	60	72.7	63	77		7				18	HPLC	74	01.2	Hc
56	Banana, fresh Silk, Pome (Australia) (M. accuminata x M. balb)	pulp	67	68 8	20	30	0					7	OCC	72.1	72 1	Rk
56	Banana, fresh Cavendish (Australia) (Musa acuminata)	pulp	65	75.2	60	70	10					18	OCC	72.1	72.1	Rk
70	Banana, raw (China) (Musa paradisica)		70	71.4							45 (30-60)	0	OCC	70	70	Rn
84	Banana, raw (CIS) (Musa paradisica)										600	[p]	unknown	84	84	-
91	Banana (Netherlands) (Musa paradisica)					20						3	HPLC	91	91	Hc
45	Banana (apple), raw (Mexico) (Musa acuminata)	fruit			17	27	6					7	HPLC	45	45	Hk
45	Banana (apple), raw (Mexico) (Musa acuminata)	fruit			14	34	30					10	HPLC	45	45	Hk
70	Banana, dwarf, raw 'fragrant banana' (China) (Musa acuminata)		57	79.8							117 (tr-250)	0	OCC	70	70	Rn
88	Bilberries, raw (Slovak republic) (Vaccinium myrtillis)					865					344	[p]	OCC	88	88	Rz
88	Black currants, raw (Slovak republic) (Ribes nigrum)					36 (29-46)					446 (425-474)	[p]	OCC	88	88	Rz

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr ref.	QM
45	Black raspberry, raw Munger (USA) (Rubus idaeus)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
45	Black raspberry, raw Munger (USA) (Rubus idaeus)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
87	Blackberries, stewed (New Zealand) (Rubus ulmifolius)					62						10	HPLC	87	87	Hn
87	Blackberries, raw (New Zealand) (Rubus ulmifolius)				0	76						13	HPLC	87	87	Hn
87	Blackberries, frozen (New Zealand) (Rubus ulmifolius)		100	83.8	0	76						13	HPLC	87	87	Hn
87	Blackberries, stewed (New Zealand) (Rubus ulmifolius)					57						10	HPLC	87	87	Hn
15	Blackberries [d], stewed (U.K.) (Rubus ulmifolius)	whole fruit	100	87.2	3	66	0					11	HPLC	77	77	Hk
15	Blackberries [d], raw (U.K.) (Rubus ulmifolius)	whole fruit	100	85.0	4	78	0					13	HPLC	77	77	Hk
87	Blackcurrant, frozen (New Zealand) (Ribes nigrum)		99	81.5	0	252						42	HPLC	87	87	Hn
84	Blueberries, raw (CIS) ()										50	[p]	unknown	84	84	-
87	Blueberry, frozen (New Zealand) (Vaccinium spp.)		100	83.4	0	204						34	HPLC	87	87	Hn
87	Boysenberries, frozen (New Zealand) (Rubus loganobaccus)		100	86.3	0	301						50	HPLC	87	87	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

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87	Boysenberries, raw (New Zealand) (Rubus loganobaccus)		100	85.2	0	301						50	HPLC	87	87	Hn
45	Breadfruit, raw (Grenada) (Artocarpus altilis)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
45	Breadfruit, raw (Grenada) (Artocarpus altilis)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
6	Buah kundang (Malaysia) (Bouea macrophylla)	fruit (mature)			0	301	155	457	0			68	HPLC	71 1	06	H'
54	Buriti, raw (Brazil, Piauí) (Mauritia vinifera)	fruit			8010	32980						6477	OCC	67	67 4	Rk
54	Caja, raw (Brazil, Rio Gra) (Spondias lutea)	fruit			30	140	1690					181	OCC	67	67 4	Rk
94	Cantaloupe, raw (Australia) (Cucumis melo spp)				30	2050			< 30			340	HPLC	94	94	Hc
56	Carambola, fresh (Australia) (Averrhoa carambola)	whole fruit	96	90.8	0	20	10					4	OCC	72 1	72 1	Rk
70	Carambola, sour, raw (China) (Averrhoa bilimbi)		91	92.5							20	0	OCC	70	70	Rn
45	Carambola, sweet, raw (Chile) (Averrhoa carambola)	fruit			13	50	ND					9	HPLC	45	45	Hk
45	Carambola, sweet, raw (Chile) (Averrhoa carambola)	fruit			19	48	ND					10	HPLC	45	45	Hk
70	Carambola, sweet, raw (China) (Averrhoa carambola)		97	91.5							30	0	OCC	70	70	Rn

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr ref.	QM
45	Carambola, tart, raw (USA) (Averrhoa carambola)	fruit			21	ND	ND					2	HPLC	45	45	Hk
45	Carambola, tart, raw (USA) (Averrhoa carambola)	fruit			45	ND	ND					4	HPLC	45	45	Hk
45	Cherimoya, white, raw (USA) (Annona cherimola)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
45	Cherimoya, white, raw (USA) (Annona cherimola)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
84	Cherries (CIS) (Prunus avium)	juice									50	[p]	unknown	84	84	-
84	Cherries, stewed (CIS) (Prunus avium)										100	[p]	unknown	84	84	-
87	Cherries, raw , Dawson (New Zealand) (Prunus avium)		89	78.2	0	25						4	HPLC	87	87	Hn
87	Cherries, raw , cooking (New Zealand) (Prunus avium)				0	26						4	HPLC	87	87	Hn
87	Cherries, stewed , cooking (New Zealand) (Prunus avium)					20						3	HPLC	87	87	Hn
87	Cherries, stewed , cooking (New Zealand) (Prunus avium)					22						4	HPLC	87	87	Hn
87	Cherries, raw , eating (New Zealand) (Prunus avium)		90	79.6	0	26						4	HPLC	87	87	Hn
87	Cherries, raw , Bing (New Zealand) (Prunus avium)		91	81.0	0	27						5	HPLC	87	87	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety, (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
84	Cherries, plain, raw (CIS) (Prunus avium)										160	[p]	unknown	84	84	-
27	Cherry, raw (Spain) (Prunus avium)	fruit, no stone (ripe)	85	84.3	2	13	5	44	10	4		3	HPLC	74	01 2	Hc
60	Cherry, fresh Lambert (Australia) (Prunus avium)		93	77 9		60					412	[p]	OCC	72 1	72 1	Rk
60	Cherry, fresh Ron's (Australia) (Prunus avium)		86	83.7		105					747	[p]	OCC	72.1	72.1	Rk
60	Cherry, fresh Eagle (Australia) (Prunus avium)		-	84.8		30					190	[p]	OCC	72.1	72.1	Rk
70	Cherry, raw (China) (Prunus spp.)		75	89.2							330	0	OCC	70	70	Rn
79	Cherry, raw (India) (Prunus spp)					140						23	HPLC	79		Hn
70	Cherry, Manchu, raw (China) (Prunus tomentosa)			89.1							0	0	OCC	70	70	Rn
70	Cherry, purple, raw (China) (Prunus spp)			80.0							110	0	OCC	70	70	Rn
70	Cherry, red, raw (China) (Prunus spp.)			83.0							150	0	OCC	70	70	Rn
47	Chinese apple (Vietnam) (Malus domestica)										120	[p]	HPLC/OCC	71	71	Hn
33	Chokeberry (Poland) (Aronia melanocarpa)	fruit (berries)				1670	1220	340	60			391	HPLC	nf	33	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr ref.	QM
15	Clementines (U K) (Citrus reticulata Clemen.)	flesh	1'0	87 5	5	73	0					13	HPLC	77	77	Hk
70	Coconut, flesh, raw (China) (Cococ nucifera)		100	47.0							0	0	OCC	70	70	Rn
5	Crabapple, raw (British Columbi) (Pyrus fusca)	fruit (mature)		79		0						0	HPLC	76 1	76	Hk
70	Crab-apple, chinese, raw (China) (Malus spp)		85	82.4							70 (50-900)	0	OCC	70	70	Rn
84	Cranberries, raw (CIS) ()										0	[p]	unknown	84	84	-
84	Currants, black, raw (CIS) ()										100	[p]	unknown	84	84	-
84	Currants, black (CIS) ()	jam									50	[p]	unknown	84	84	-
84	Currants, black (CIS) ()	juice									50	[p]	unknown	84	84	-
84	Currants, red, raw (CIS) ()										200	[p]	unknown	84	84	-
84	Currants, white, raw (CIS) ()										40	[p]	unknown	84	84	-
56	Custard apple, fresh (Australia) (Annona atemoya)	pulp	72	78.7	10	0	0					1	OCC	72 1	72.1	Rk
79	Dates, Indian, raw (India) (Phoenix spp.)					2900						483	HPLC	79		Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

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70	Emblic, raw (China) (Phyllanthus emblica)		80	78.7							50	0	OCC	70	70	Rn
45	Feijoa, raw (USA) (Feijoa sellowiana)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
45	Feijoa, raw (USA) (Feijoa sellowiana)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
87	Feijoa, raw, Triumph (New Zealand) (Feijo sellowiana)	flesh	59	85.4	0	30						5	HPLC	87	87	Hn
87	Feijoa, raw, Mammoth (New Zealand) (Feijo sellowiana)	flesh	43	84.7	0	33						6	HPLC	87	87	Hn
87	Feijoa, raw (New Zealand) (Feijo sellowiana)		51	85.4	0	31						5	HPLC	87	87	Hn
84	Fig, raw (CIS) (Ficus carica)										50	[p]	unknown	84	84	-
90	Fig, raw (Ethiopia) (Ficus carica)					50						8	Spectr.	90	90	O
96	Fig, dried (Australia) (Ficus carica)				0	9	0					2	HPLC	96	96	Hn
96	Fig, raw (Australia) (Ficus carica)				10	80	130					26	HPLC	96	96	Hn
70	Fig, common, raw (China) (Ficus carica)		74	83.6							50	0	OCC	70	70	Rn
91	Fruit cocktail (Netherlands) ()					70						12	HPLC	91	91	Hc

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref	Chr. ref.	QM
85	Fruit juice (Croatia) ()	juice				1130					1490	[p]	OCC	85	85	Rn
84	Gooseberry, raw (CIS) ()										20	[p]	unknown	84	84	-
15	Grapefruit (U K) (Citrus paradisi)		100	89.0	9	12	0					3	HPLC	77	77	Hk
36	Grapefruit, raw Texas (USA) (Citrus paradisi)	fruit (ripe)				360	30 [b]					63	HPLC	36	36	Hk
36	Grapefruit, raw Coachella (USA) (Citrus paradisi)	fruit (ripe)				260	30 [b]					46	HPLC	36	36	Hk
82	Grapefruit, fresh (Egypt) (Citrus paradisi)	juice									0	[p]	OCC	71	71	Rn
82	Grapefruit, fresh (Egypt) (Citrus paradisi)	fruit									200	[p]	OCC	71	71	Rn
84	Grapefruit, raw (CIS) (Citrus paradisi)										20	[p]	unknown	84	84	-
87	Grapefruit, canned (New Zealand) (Citrus paradisi)				0	0						0	HPLC	87	87	Hn
87	Grapefruit, raw (New Zealand) (Citrus paradisi)				0	0						0	HPLC	87	87	Hn
87	Grapefruit, raw , Morrsion's (New Zealand) (Citrus hybrid)	flesh	41	88.4	0	0						0	HPLC	87	87	Hn
91	Grapefruit (Netherlands) (Citrus paradisi)					0						0	HPLC	91	91	Hc

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref	QM
96	Grapefruit, raw, peeled (Australia) (Citrus paradisi)				10	20	NA					4	HPLC	96	96	Hn
68	Grapefruit, red, fresh Ray Ruby, new cultiv. (USA) (Citrus paradisi)	flesh				700			2060		3580	[p]	HPLC	68	68	Hk
68	Grapefruit, red, fresh Ruby red (Ind river) (USA) (Citrus paradisi)	flesh				420			160		1050	[p]	HPLC	68	68	Hk
68	Grapefruit, red, fresh Star ruby, new cultiv. (USA) (Citrus paradisi)	flesh				960			3330		11170	[p]	HPLC	68	68	Hk
68	Grapefruit, red, fresh Ruby red (interior) (USA) (Citrus paradisi)	flesh				420			290		1210	[p]	HPLC	68	68	Hk
68	Grapefruit, red, fresh Flame (new cultivar) (USA) (Citrus paradisi)	flesh				860			790		3440	[p]	HPLC	68	68	Hk
84	Grapes (CIS) (Vitis vinifera)	juice									0	[p]	unknown	84	84	-
96	Grape, Cornichon, raw (Australia) (Vitis vinifera)				10	40	20					9	HPLC	96	96	Hn
96	Grape, Waltham Cross, raw (Australia) (Vitis vinifera)				20	30	10					8	HPLC	96	96	Hn
96	Grape, black, raw (Australia) (Vitis vinifera)				13	43	20					10	HPLC	96	96	Hn
96	Grape, black muscatel, raw (Australia) (Vitis vinifera)				20	50	20					12	HPLC	96	96	Hn
96	Grape, green sultana, raw (Australia) (Vitis vinifera)				10	30	140					19	HPLC	96	96	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
96	Grape, ruby sultana, raw (Australia) (Vitis vinifera)				10	40	20					9	HPLC	96	96	Hn
91	Grape, with skin (Netherlands) (Vitis vinifera)					20						3	HPLC	91	91	Hc
45	Guava, raw common (USA) (Psidium guayava)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
45	Guava, raw common (USA) (Psidium guayava)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
56	Guava, fresh '1156', Hawaiian type (Australia) (Psidium guayava)	whole fruit	98	87.2	0	380	110					73	GCC	72.1	72 1	Rk
61	Guava, fresh (Brazil) (Psidium guayava)	pulp (ripe)				415			5310			69	HPLC	61	61	Hn
79	Guava, raw (India) (Psidium guajava)					1						0	HPLC	79		Hn
83	Guava (Mexico) (Psidium guajava)										1470	[p]	unknown	83	83	O
61	Guava juice (Brazil) (Psidium guayava)	juice				330			2590			55	HPLC	61	61	Hn
6	Jackfruit (Malaysia) (Artocarpus heterophyllus)	fruit (mature)			0	56	17	95	0			11	HPLC	71.1	06	Hk
47	Jackfruit (Vietnam) (Artocarpus integrifolia)					tr					370	[p]	HPLC/OCC	71	71	Hn
56	Jackfruit, fresh (Australia) (Artocarpus heterophyllus)	pulp	19	75.4	20	70	210					33	OCC	72.1	72.1	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
79	Jackfruit, raw (India) (Artocarpus integrifolia)					130						22	HPLC	79		Hn
70	Jackfruit, raw (China) (Artocarpus heterophyllus)		33	78.9							30	0	OCC	70	70	Rn
70	Jujube, raw (China) (Ziziphus spp.)		91	73.4							260 (10-500)	0	OCC	70	70	Rn
79	Jumbo, raw (India) (Syzygium)					40						7	HPLC	79		Hn
28	Kiwifruit, raw Hayward (Spain) (Actinidia chinensis)	fruit (ripe)				36		290				6	HPLC	28	78.1	Hc
28	Kiwifruit, raw Abbot (Spain) (Actinidia chinensis)	fruit (ripe)				65		259				11	HPLC	28	78 1	Hc
28	Kiwifruit, raw Monty (Spain) (Actinidia chinensis)	fruit (ripe)				5		316				1	HPLC	28	78 1	Hc
28	Kiwifruit, raw Bruno (Spain) (Actinidia chinensis)	fruit (ripe)				41		281				7	HPLC	28	78.1	Hc
56	Kiwifruit, fresh Australian grown (Australia) (Actinidia chinensis)	pulp, seeds	80	82.3	20	70	0					13	OCC	72.1	72 1	Rk
56	Kiwifruit, fresh New Zealand grown (Australia) (Actinidia chinensis)	pulp, seeds	75	83.2	20	50	0					10	OCC	72.1	72 1	Rk
87	Kiwifruit, raw , Bruno (New Zealand) (Actinidia deliciosa del.)	flesh	79	84.9	19	49	0					10	HPLC	87	87	Hn
87	Kiwifruit, raw (New Zealand) (Actinidia deliciosa del.)		78	83.7	19	49	0					10	HPLC	87	87	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
87	Kiwifruit, raw , Hayward (New Zealand) (Actinidia deliciosa del.)	flesh		82.9	19	49	0					10	HPLC	87	87	Hn
91	Kiwifruit (Netherlands) (Actinidia chinensis)					30						5	HPLC	91	91	Hc
45	Kumquats, raw (USA) (Fortunella margarita)	fruit			160	ND	220					34	HPLC	45	45	Hk
45	Kumquats, raw (USA) (Fortunella margarita)	fruit			150	ND	166					28	HPLC	45	45	Hk
27	Lemon, raw (Spain) (Citrus limonis)	fruit, peeled (ripe)	60	89.4		0	14	2		1		1	HPLC	74	01.2	Hc
82	Lemon, fresh (Egypt) (Citrus limon)	fruit									1200	[p]	OCC	71	71	Rn
82	Lemon, fresh (Egypt) (Citrus limon)	juice									0	[p]	OCC	71	71	Rn
84	Lemon, raw (CIS) (Citrus limon)										10	[p]	unknown	84	84	-
84	Lemon (CIS) (Citrus limon)	juice									0	[p]	unknown	84	84	-
96	Lemon, raw, peeled (Australia) (Citrus limon)				tr	10	NA					2	HPLC	96	96	Hn
96	Lime, raw, peeled (Australia) ()				1	30	NA					5	HPLC	96	96	Hn
56	Loquat, fresh (Australia) (Eriobotyra japonica)	pulp	65	90.6	170	380	100					87	OCC	72.1	72.1	Rk

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
70	Loquat, raw (China) (Eriobotyra japonica)		61	90.0							1520	0	OCC	70	70	Rn
45	Lychee, raw (USA) (Litchi chinensis)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
45	Lychee, raw (USA) (Litchi chinensis)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
56	Lychee, fresh (Australia) (Litchi chinensis)	pulp	72	80.6	0	0	0					0	OCC	72.1	72 1	Rk
45	Lychee, dried, raw (USA) (Litchi chinensis)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
45	Lychee, dried, raw (USA) (Litchi chinensis)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
54	Mamey, raw (Brazil, Maranha) (Mammea americana)	flesh				1410						235	OCC	67	67 4	Rk
83	Mammey sapote (Mexico) (Calocarpum mammosum)										1460	[p]	unknown	83	83	O
91	Mandarin (Netherlands) (Citrus reticulata)					70						12	HPLC	91	91	Hc
96	Mandarin, raw, peeled (Australia) (Citrus reticulata)				15	67	NA					12	HPLC	96	96	Hn
96	Mandarin, canned, drained (Australia) (Citrus reticulata)				0	130	0					22	HPLC	96	96	Hn
96	Mandarin, canned (Australia) (Citrus reticulata)				tr	74	tr					12	HPLC	96	96	Hn

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext ref.	Chr. ref.	QM
96	Mandarin, raw, peeled (Australia) (Citrus reticulata)				20	90	NA					17	HPLC	96	96	Hn
6	Mandarin orange (Malaysia) (Citrus reticulata)	fruit (mature)			0	81	688	113	0			81	HPLC	71 1	06	Hk
36	Mango, raw (USA) (Mangifera indica)	fruit (ripe)				13120	1550 [b]					2329	HPLC	36	36	Hk
47	Mango (Vietnam) (Mangifera indica)										600	[p]	HPLC/OCC	71	71	Hn
45	Mango, raw Keitt (USA) (Mangifera indica)	fruit			ND	300	ND					50	HPLC	45	45	Hk
45	Mango, raw Keitt (USA) (Mangifera indica)	fruit			40	690	ND					118	HPLC	45	45	Hk
45	Mango, raw Tommy Atkins (Mexico) (Mangifera indica)	fruit			ND	300	22					52	HPLC	45	45	Hk
45	Mango, raw Tommy Atkins (Mexico) (Mangifera indica)	fruit			34	490	ND					85	HPLC	45	45	Hk
56	Mango, fresh Kensington Pride (Australia) (Mangifera indica)	pulp	73	82.8	10	1550	1640					410	OCC	72 1	72 1	Rk
54	Mango, raw Tommy Atkins (Brazil, Mato Gr) (Mangifera indica)	fruit				1550	40					262	OCC	67	67 4	Rk
54	Mango, raw Haden (Brazil, Sao Pau) (Mangifera indica)	flesh				1250	30					211	OCC	67	67 4	Rk
61	Mango, fresh (Brazil) (Mangifera indica)	pulp (ripe)				1510						252	HPLC	61	61	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

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79	Mango, raw (India) (Mangifera indica)					1990						332	HPLC	79		Hn
70	Mango, raw (China) (Mangifera indica)		65	84.5							5070 (3810-5700)	0	OCC	70	70	Rn
83	Mango (Mexico) (Mangifera indica)										3000	[p]	unknown	83	83	O
18	Mango Amelie, dried Amelie (Mali) (Mangifera indica)			17.0	< 60	2640						445	HPLC	74	-	Hn
18	Mango Batiste, dried Batiste (Haiti) (Mangifera indica)			11.0	< 50	6080						1018	HPLC	74	-	Hn
18	Mango Nimrode, dried Nimrode (Mali) (Mangifera indica)			18.0	< 60	2830						477	HPLC	74	-	Hn
61	Mango juice (Brazil) (Mangifera indica)	juice				530						88	HPLC	61	61	Hn
6	Mango, black-gold (Malaysia) (Mangifera indica)	fruit (mature)			0	615	0	0	0			103	HPLC	71.1	06	Hk
70	Mango, small, raw (China) (Mangifera silvatica)		45	80.4							850	0	OCC	70	70	Rn
15	Melon Cantaloupe (U.K.) (Cucumis melo cantloupens.)	flesh	100	92.1	16	990	0					166	HPLC	77	77	Hk
45	Melon, raw Casaba (USA) (Cucumis melo)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
45	Melon, raw Canary (USA) (Cucumis melo)	fruit			ND	47	ND					8	HPLC	45	45	Hk

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45	Melon, raw Canary (USA) (Cucumis melo)	fruit			ND	60	ND					10	HPLC	45	45	Hk
45	Melon, raw Casaba (USA) (Cucumis melo)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
45	Melon, raw Crenshaw (USA) (Cucumis melo)	fruit			30	300	ND					53	HPLC	45	45	Hk
45	Melon, raw Crenshaw (USA) (Cucumis melo)	fruit			ND	600	28					103	HPLC	45	45	Hk
84	Melon, raw (CIS) (Cucumis melo)										400	[p]	unknown	84	84	-
87	Melon, raw , Rock, Winstone (New Zealand) (Cucumis melo reticulatus)	flesh	52	89.2	0	220						37	HPLC	87	87	Hn
87	Melon, raw , Rock (New Zealand) (Cucumis melo reticulatus)		51	90 0	0	205						34	HPLC	87	87	Hn
56	Melon, honeydew, fresh white skin (Australia) (Cucumis melo inodorus)	pulp	70	89.8	0	30	0					5	OCC	72.1	72 1	Rk
56	Melon, honeydew, fresh yellow skin (Australia) (Cucumis melo inodorus)	pulp	62	92.7	10	50	0					9	OCC	72.1	72.1	Rk
91	Melon, honeydew (Netherlands) (Cucumis melo)					40						7	HPLC	91	91	Hc
45	Melon, pepino, raw (New Zealand) (Cucumis spp)	fruit			ND	120	ND					20	HPLC	45	45	Hk
45	Melon, pepino, raw (New Zealand) (Cucumis spp.)	fruit			ND	130	ND					22	HPLC	45	45	Hk

Carotenoid content of food (µg/100g edible portion fresh weight)

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56	Melon, rock cantaloupe, fresh (Australia) (Cucumis melo reticulatus)	pulp	51	90 6	0	60	0					10	OCC	72 1	72.1	Rk
56	Melon, rock cantaloupe, fresh (Australia) (Cucumis melo reticulatus)	pulp	63	92.3	10	810	40					140	OCC	72 1	72.1	kk
70	Melon, snake, raw (China) (Cucumis melo flexuosus)		83	95.4							73 (10-180)	0	OCC	70	70	Rn
56	Melon, water, fresh (Australia) (Citrallus lanatus)	pulp	50	92 7	0	360	10					61	OCC	72.1	72.1	Rk
56	Melon, water, fresh (Australia) (Citrallus lanatus)	pulp	51	92.5	0	180	0					30	OCC	72.1	72 1	Rk
47	Momordica (Vietnam) (Momordica cochinchinensis)					18810					89150	[p]	HPLC/OCC	71	71	Hn
84	Mulberry (CIS) (Morus alba)	fruit									20	[p]	unknown	84	84	-
96	Mulberry, raw (Australia) (Morus alba)				0	10	0					2	HPLC	96	96	Hn
70	Mulberry, purple, raw (China) (Morus alba)		95	82.0							10	0	OCC	70	70	Rn
70	Mulberry, white, raw (China) (Morus alba)		94	85.0							10	0	OCC	70	70	Rn
6	Musk lime (Malaysia) (Citrus microcarpa)	fruit (mature)			0	12	446	65	0			43	HPLC	71.1	06	Hk
60	Nectarine, fresh Goldmine (Australia) (Prunus persica)		93	87.1	3	25					97	[p]	OCC	72.1	72.1	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

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54	Nectarine, raw (Brazil, Sao Pau) (Prunus persica)	fruit				110	390					54	OCC	67	67 4	Rk
60	Nectarine, fresh Redgold (Australia) (Prunus persica)		95	88.4		50					1331	[p]	OCC	72 1	72 1	Rk
60	Nectarine, fresh Nectared (Australia) (Prunus persica)		92	86.2		120					1405	[p]	OCC	72.1	72 1	Rk
70	Nectarine, raw (China) (P persica nucipersica)			86.0							120	0	OCC	70	70	Rn
87	Nectarine, raw , Fantasia (New Zealand) (Prunus persica)		92	87 6	0	316						53	HPLC	87	87	Hn
87	Nectarine, raw , Red Gold (New Zealand) (Prunus persica)		92	86.7	0	407						68	HPLC	87	87	Hn
87	Nectarine, raw (New Zealand) (Prunus persica)		92	87.2	0	362						60	HPLC	87	87	Hn
15	Nectarines (U K) (Prunus persica nectarina)	flesh and skin	100	88.9	tr	45	26					10	HPLC	77	77	Hk
70	Oleaster, dried, raw (China) (Elaeagnus angustifolia)			12.0							0	0	OCC	70	70	Rn
56	Olive, green, fresh green skin and flesh (Australia) (Olea europaea)	pulp, skin	73	78.1	100	200	20					44	OCC	72.1	72 1	Rk
39	Olive, green table, raw Manzanilla (Spain) (Olea europaea)					236		430				39	LC	39	39	Rz
6	Orange (Malaysia) (Citrus nobilis)	fruit (mature)			0	25	332	30	0			35	HPLC	71.1	06	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

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26	Orange, raw (Egypt) (Citrus sinensis)				32	75						15	HPLC	74	74	Hk
27	Orange, raw (Spain) (Citrus sinensis)	fruit, peeled (ripe)	72	85.9	13	48	448	68		66		50	HPLC	74	01 2	Hc
47	Orange (Vietnam) (Citrus nobilis)										80	[p]	HPLC/OCC	71	71	Hn
47	Orange (Vietnam) (Citrus nobilis)										3500	[p]	HPLC/OCC	71	71	Hn
70	Orange, raw (China) (Citrus spp.)		63	88.3							50	0	OCC	70	70	Rn
82	Orange, fresh (Egypt) (Citrus aurantium)	juice									2600	[p]	OCC	71	71	Rn
79	Orange, raw (India) (Citrus aurantium)					190						32	HPLC	79		Hn
82	Orange, fresh (Egypt) (Citrus aurantium)	fruit									4200	[p]	OCC	71	71	Rn
84	Orange (CIS) (Citrus sinensis)	juice									50	[p]	unknown	84	84	-
91	Orange (Netherlands) (Citrus sinensis)					0						0	HPLC	91	91	Hc
96	Orange, raw, peeled Valencia (Australia) (Citrus sinensis)				20	120	NA					22	HPLC	96	96	Hn
96	Orange, raw, peeled (Australia) (Citrus sinensis)				21	97	NA					18	HPLC	96	96	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

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36	Orange concentrate Temple (USA) (Citrus spp.)					80	120 [b]					24	HPLC	36	36	Hk
36	Orange concentrate Navel (USA) (Citrus spp.)					130	720 [b]					88	HPLC	36	36	Hk
36	Orange concentrate Valencia (USA) (Citrus spp.)					260	300 [b]					71	HPLC	36	36	Hk
93	Orange concentrate California Navel (U.S.A.) (Citrus sinensis)					201						34	HPLC	93	93	Hk
93	Orange concentrate Valencia (U.S.A.) (Citrus sinensis)					120						20	HPLC	93	93	Hk
15	Orange juice, fresh (U.K.) (Citrus sinensis)		100	87.7	12	245	1395					170	HPLC	77	77	Hk
85	Orange juice (Croatia) (Citrus sinensis)	juice									250	[p]	OCC	85	85	Rn
91	Orange juice (Netherlands) (Citrus sinensis)	juice				0						0	HPLC	91	91	Hc
15	Oranges, fresh assorted var (U.K.) (Citrus sinensis)		100	86.1	8	24	tr					5	HPLC	77	77	Hk
45	Orange, blood, raw (USA) (Citrus sinensis)	fruit			ND	140	80					31	HPLC	45	45	Hk
45	Orange, blood, raw (USA) (Citrus sinensis)	fruit			ND	100	58					22	HPLC	45	45	Hk
96	Orange, navel, raw, peeled (Australia) (Citrus sinensis)				22	71	NA					14	HPLC	96	96	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	GM
70	Orange, sweet, raw (China) (Citrus sinensis)		74	83.0							37 (20-60)	0	OCC	70	70	Rn
6	Papaya (Malaysia) (Carica papaya)	fruit (mature)			0	228	1483	0	2003			184	HPLC	71.1	06	Hk
18	Papaya, dried (Dominican Repub) (Carica papaya)			92.4	< 60	75						18	HPLC	74	-	Hn
18	Papaya, dried (Mali) (Carica papaya)				< 60	350						64	HPLC	74	-	Hn
17	Papaya Tailandia (Brazil) (Carica papaya)	flesh				170	1030		4750		6750	123	OCC	67	67 5	Rk
16	Papaya, raw Formosa (Brazil, Sao Pau) (Carica papaya)	flesh (ripe)				140 (70-200)	530 (400-690)		1910 (1460-2390)		3300	72	OCC	67	67.6	Rk
16	Papaya, raw Solo (Brazil) (Carica papaya)	flesh (ripe)				250 (90-360)	910 (670-1240)		2100 (1670-3100)		3420	127	OCC	67	67 6	Rk
20	Papaya, raw Formosa (Brazil) (Carica papaya)	flesh				185	660					92	HPLC	67	67 2	Rk
16	Papaya, raw Tailandia (Brazil) (Carica papaya)	flesh (ripe)				230 (170-310)	970 (780-1260)		4000 (3210-4730)		6030	128	OCC	67	67 6	Rk
16	Papaya, raw Formosa (Brazil, Bahia) (Carica papaya)	flesh (ripe)				610 (410-810)	860 (620-1170)		2650 (2230-2960)		4780	181	OCC	67	67 6	Rk
16	Papaya, raw common (Brazil) (Carica papaya)	flesh (ripe)				120 (60-290)	810 (580-990)		ND		1300	95	OCC	67	67 6	Rk
12	Papaya, raw Formosa (Brazil) (Carica papaya)	flesh (ripe)				123	462					63	OCC	67	67 3	Rc

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr ref.	QM
36	Papaya, raw (USA) (Carica papaya)	fruit (ripe)				910	60 [b]					157	HPLC	36	36	Hk
47	Papaya (Vietnam) (Carica papaya)					1210					2960	[p]	HPLC/OCC	71	71	Hn
46	Papaya, raw Subang (Malaysia) (Carica papaya)	fruit (ripe)									10670	0	Spectr	71 2	46	O
54	Papaya, raw Tailandia (Brazil, Bahia) (Carica papaya)	flesh				260	1020					137	OCC	67	67 4	Rk
54	Papaya, raw Solo (Brazil, Sao Pau) (Carica papaya)	flesh			tr	300	760					120	OCC	67	67.4	Rk
70	Papaya, raw (China) (Carica papaya)		84	92.3							30	0	OCC	70	70	Rn
61	Papaya, fresh (Brazil) (Carica papaya)	pulp (ripe)				125	680		2080			83	HPLC	61	61	Hn
65	Papaya, fresh (USA) (Carica papaya)	flesh (ripe)				71	214					32	HPLC	36	36	Hk
79	Papaya, raw (India) (Carica papaya)					830						138	HPLC	79		Hn
6	Papaya exotica (Malaysia) (Carica papaya)	fruit (mature)			0	321	615	0	2333			125	HPLC	71.1	06	Hk
56	Passion fruit, fresh purple skin (Australia) (Passiflora edulis)	pulp, seeds	42	74.4	410	360	370					130	OCC	72 1	72 1	Rk
45	Passion fruit, purple, raw (USA) (Passiflora edulis)	fruit			ND	1150	40					195	HPLC	45	45	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref	Chr ref.	QM
45	Passion fruit, purple, raw (USA) (Passiflora edulis)	fruit			ND	336	42					60	HPLC	45	45	Hk
45	Passion fruit, yellow, raw (USA) (Passiflora edulis)	fruit			ND	300	40					54	HPLC	45	45	Hk
45	Passion fruit, yellow, raw (USA) (Passiflora edulis)	fruit			70	750	53					136	HPLC	45	45	Hk
54	Passionfruit, raw Manao (Brazil, Sao Pau) (Passiflora edulis)	pulp				470						78	OCC	67	67.4	Rk
56	Pawpaw (papaya), fresh orange flesh (Austr.) (Australia) (Carica papaya)	pulp	70	89.3	0	240	1350					164	OCC	72.1	72 1	Rk
15	Peach, raw (U K) (Prunus persica)	flesh and skin	100	88.4	tr	45	26					10	HPLC	77	77	Hk
15	Peach, dried (U.K) (Prunus persica)	flesh	100	15.5	tr	345	200					76	HPLC	77	77	Hk
36	Peach, raw Elberta (USA) (Prunus persica)	fruit (ripe)				60	30 [b]					13	HPLC	36	36	Hk
36	Peach, raw Cling (USA) (Prunus persica)	fruit (ripe)				220	40 [b]					40	HPLC	36	36	Hk
27	Peach, raw (Spain) (Hybrid Prunus persica)	fruit, peeled (ripe)	69	86.5	4	64	74	16		31		18	HPLC	74	01.2	Hc
60	Peach, fresh Blackburn (Australia) (Prunus persica)		96	87.6		130					1425	[p]	OCC	72 1	72.1	Rk
60	Peach, fresh Elberta (Australia) (Prunus persica)		91	88.5		165					1500	[p]	OCC	72.1	72.1	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
60	Peach, fresh Cardinal (Australia) (Prunus persica)		87	88.3		40					668	[p]	OCC	72.1	72.1	Rk
54	Peach, raw Diamante (Brazil, Sao Pau) (Prunus persica)	fruit				60	410					48	OCC	67	67.4	Rk
54	Peach, raw Chilean (Chile) (Prunus persica)	fruit				120	510					67	OCC	67	67.4	Rk
60	Peach, fresh Redhaven (Australia) (Prunus persica)		92	90.9		65					915	[p]	OCC	72.1	72.1	Rk
60	Peach, fresh Fragar (Australia) (Prunus persica)		84	88.6		30					259	[p]	OCC	72.1	72 1	Rk
60	Peach, fresh J.H Hale (Australia) (Prunus persica)		89	88.9	5	180					1464	[p]	OCC	72.1	72 1	Rk
60	Pearh, fresh Halehaven (Australia) (Prunus persica)		95	88.3		130					2579	[p]	OCC	72.1	72.1	Rk
60	Peach, fresh Maygold (Australia) (Prunus persica)		87	89.5		40					385	[p]	OCC	72.1	72.1	Rk
84	Peach, raw (CIS) (Prunus persica)										500	[p]	unknown	84	84	-
84	Peach, stewed (CIS) (Prunus persica)										600	[p]	unknown	84	84	-
84	Peach (CIS) (Prunus persica)	juice									300	[p]	unknown	84	84	-
84	Peach (CIS) (Prunus persica)	jam									100	[p]	unknown	84	84	-

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref	Chr. ref.	QM
87	Peach, canned in syrup (New Zealand) (Prunus persica)		100	82 9		617						103	HPLC	87	87	Hn
87	Peach, raw , Red Haven (New Zealand) (Prunus persica)		93	87 3	0	440						73	HPLC	87	87	Hn
87	Peach, raw , Springcrest (New Zealand) (Prunus persica)		94	89.4	0	282						47	HPLC	87	87	Hn
87	Peach, raw , Flamecrest (New Zealand) (Prunus persica)		95	88.8	0	614						102	HPLC	87	87	Hn
87	Peach, canned (New Zealand) (Prunus persica)					377						63	HPLC	87	87	Hn
87	Peach, raw (New Zealand) (Prunus persica)		90	87.6	0	477						80	HPLC	87	87	Hn
87	Peach, raw , Golden Dust (New Zealand) (Prunus persica)		80	86.0	0	477						80	HPLC	87	87	Hn
87	Peach, raw , Mary's Choice (New Zealand) (Prunus persica)		89	86.0	0	477						80	HPLC	87	87	Hn
87	Peach, raw , Golden Queen (New Zealand) (Prunus persica)		87	87.0	0	477						80	HPLC	87	87	Hn
87	Peach, raw , Million Dollar (New Zealand) (Prunus persica)		90	89 0	0	477						80	HPLC	87	87	Hn
87	Peach, dried, stewed (New Zealand) (Prunus persica)					1480						247	HPLC	87	87	Hn
87	Peach, dried, stewed (New Zealand) (Prunus persica)					1439						240	HPLC	87	87	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr. ref.	QM
87	Peach, dried (New Zealand) (Prunus persica)		100	16 2		3660						610	HPLC	87	87	Hn
91	Peach (Netherlands) (Prunus persica)					90						15	HPLC	91	91	Hc
88	Peach, raw (Slovak republic) (Prunus persica)					37					1360	[p]	OCC	88	88	Rz
27	Pear, raw (Spain) (Pyrus communis)	fruit, peeled (ripe)	80	83.0		3	3	11				1	HPLC	74	01.2	Hc
55	Pear, fresh Williams Bon Cretien (Australia) (Pyrus communis)	skin plus corte	89	82.9	0	20	10					4	OCC	72.1	72 1	Rk
55	Pear, fresh Packham's Triumph (Australia) (Pyrus communis)	skin plus corte	90	81.9	0	20	0					3	OCC	72.1	72.1	Rk
55	Pear, fresh Buerre Bosc (Australia) (Pyrus communis)	skin plus corte	86	79.3	0	10	0					2	OCC	72.1	72.1	Rk
84	Pear (CIS) (Pyrus communis)	jam									0	[p]	unknown	84	84	-
84	Pear, raw (CIS) (Pyrus communis)										10	[p]	unknown	84	84	-
87	Pear, canned , Williams bon Chretien (New Zealand) (Pyrus communis)		100	81.8	0	15						3	HPLC	87	87	Hn
87	Pear, raw , Williams bon Chretien (New Zealand) (Pyrus communis)			85.3	0	10						2	HPLC	87	87	Hn
87	Pear, raw , Buerre Bosc (New Zealand) (Pyrus communis)		84	85.0	0	10						2	HPLC	87	87	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref	Chr. ref.	QM
87	Pear, raw , eating (New Zealand) (Pyrus communis)	flesh			0	11						2	HPLC	87	87	Hn
87	Pear, raw , cooking (New Zealand) (Pyrus communis)	flesh			0	11						2	HPLC	87	87	Hn
87	Pear, canned , fruit&syrup (New Zealand) (Pyrus communis)				0	15						3	HPLC	87	87	Hn
87	Pear, stewed , cooking (New Zealand) (Pyrus communis)					8						1	HPLC	87	87	Hn
87	Pear, raw , Packham's Triumph (New Zealand) (Pyrus communis)		92	84.4	0	10						2	HPLC	87	87	Hn
87	Pear, raw , Louise Bonne de Jersey (New Zealand) (Pyrus communis)		82	85.0	0	10						2	HPLC	87	87	Hn
87	Pear, stewed , cooking (New Zealand) (Pyrus communis)					9						2	HPLC	87	87	Hn
87	Pear, canned in syrup (New Zealand) (Pyrus communis)			81.8	0	150						25	HPLC	87	87	Hn
87	Pear, raw (New Zealand) (Pyrus communis)		88	84.9	0	10						2	HPLC	87	87	Hn
70	Pear, common, raw (China) (Pyrus communis)		92	83.5							750 (650-850)	0	OCC	70	70	Rn
70	Pear, white, raw (China) (Pyrus spp.)		87	88.7							110 (10-210)	0	OCC	70	70	Rn
56	Pepino, fresh (Australia) (Solanum muricatum)	pulp, seeds	91	93.4	0	170	10					29	OCC	72.1	72.1	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr. ref.	QM
36	Persimmon, raw (USA) (Diospyrous kaki)	fruit (ripe)				240	50 [b]					45	HPLC	36	36	Hk
51	Persimmon, raw (Hungary, Szente) (Diospyrous kaki)	fruit (ripe)				1160	270					281	HPLC	44	44.1	Hn
56	Persimmon, fresh (Australia) (Diospyrous kaki)	pulp	69	79.7	20	200	1230					148	OCC	72.1	72.1	Rk
65	Persimmon, fresh (USA) (Diospyrous kaki)	flesh (ripe)				266	288		110			71	HPLC	36	36	Hk
70	Persimmon, raw (China) (Diospyros kaki constricta)		70	70.0							150	0	OCC	70	70	Rn
84	Persimmon, raw (CIS) (Diospyros kaki)										1200	[p]	unknown	84	84	-
45	Persimmon, dried, raw (USA) (Diospyrous kaki)	fruit			19	527	210					109	HPLC	45	45	Hk
45	Persimmon, dried, raw (USA) (Diospyrous kaki)	fruit			17	220	101					47	HPLC	45	45	Hk
47	Persimmon, kaki (Vietnam) (Diospyrous kaki)										1690	[p]	HPLC/OCC	71	71	Hn
36	Pineapple, raw (USA) (Ananas comosus)	fruit (ripe)				30						5	HPLC	36	36	Hk
45	Pineapple, raw, dried (USA) (Ananas comosus)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
46	Pineapple, raw Mauritius (Malaysia) (Ananas comosus)	fruit (ripe)									2520	0	Spectr.	71.2	46	O

Carotenoid content of food (µg/100g edible portion, fresh weight)

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45	Pineapple, raw, dried (USA) (Ananas comosus)	fruit			ND	ND	ND					0	HPLC	45	45	Hk
47	Pineapple (Vietnam) (Agare americana)										200	[p]	HPLC/OCC	71	71	Hn
56	Pineapple, fresh Cayenne type (Australia) (Ananas comosus)	pulp	67	86.0	0	10	30					4	OCC	72.1	72.1	Rk
70	Pineapple, raw (China) (Ananas spp)		56	87.8							85 (80-90)	0	OCC	70	70	Rn
84	Pineapple, raw (CIS) (Ananas spp.)										40	[p]	unknown	84	84	-
54	Piqui, raw (Brazil, Piaui) (Cariocar villosium)	pulp				120	440					60	OCC	67	67.4	Rk
11	Pitanga, raw (Brazil, Pernamb) (Eugenia uniflora)	fruit (ripe)				950	4700		7300			[p]	OCC	67	67	Rk
54	Pitanga, raw (Brazil, Campina) (Eugenia uniflora)	fruit				370	1230					178	OCC	67	67 4	Rk
60	Plum, fresh Greengage (Australia) (P unus domestica)		93	86.7		95					453	[p]	OCC	72.1	72 1	Rk
60	Plum, fresh Blood (Australia) (Prunus domestica)		98	86.6		225					663	[p]	OCC	72.1	72.1	Rk
60	Plum, fresh Santa Rosa (Australia) (Prunus domestica)		94	88.4		105					260	[p]	OCC	72 1	72 1	Rk
60	Plum, fresh Mariposa (Australia) (Prunus domestica)		96	87.1		210					778	[p]	OCC	72.1	72.1	Rk

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr. ref.	QM
60	Plum, fresh Narrabeen (Australia) (Prunus domestica)		98	89 4	5	90					412	[p]	OCC	72.1	72 1	Rk
60	Plum, fresh Wilson (Australia) (Prunus domestica)		94	88 5		155					313	[p]	OCC	72 1	72.1	Rk
70	Plum, raw (China) (Prunus spp)		95	85.7							200 (70-420)	0	OCC	70	70	Rn
84	Plum, raw (CIS) (Prunus spp)	juice									150	[p]	unknown	84	84	-
84	Plum, raw (CIS) (Prunus spp)	jam									50	[p]	unknown	84	84	-
84	Plum, stewed (CIS) (Prunus spp)										0	[p]	unknown	84	84	-
84	Plum, raw (CIS) (Prunus spp)										100	[p]	unknown	84	84	-
87	Plum, raw (New Zealand) (Prunus domestica)		90	85.4	0	417						70	HPLC	87	87	Hn
87	Plum, stewed , cooking (New Zealand) (Prunus domestica)					92						15	HPLC	87	87	Hn
87	Plum, stewed , cooking (New Zealand) (Prunus domestica)					92						15	HPLC	87	87	Hn
87	Plum, raw , Paterson Late (New Zealand) (Prunus domestica)		82	83.0	0	417						70	HPLC	87	87	Hn
87	Plum, raw , Omega (New Zealand) (Prunus domestica)		92	83.0	0	417						70	HPLC	87	87	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext ref.	Chr ref	GM
87	Plum, canned in syrup , G Wilson (New Zealand) (Prunus domestica)		98	70.6	0	479						80	HPLC	87	87	Hn
87	Plum, raw , Coe's Golden Drop (New Zealand) (Prunus domestica)		88	84 0	0	417						70	HPLC	87	87	Hn
88	Plum, raw (Slovak republic) (Prunus domestica)					374 (120-603)					1620 (1060-2400)	[p]	OCC	88	88	Rz
87	Plum, raw , Victoria Dessert (New Zealand) (Prunus domestica)				0	417						70	HPLC	87	87	Hn
87	Plum, raw , Black Doris (New Zealand) (Prunus domestica)		97	87.0	0	370						62	HPLC	87	87	Hn
6	Plum, red (Malaysia) (Prunus domestica)	fruit (mature)			0	127	40	149				25	HPLC	71.1	06	Hk
91	Plum, unpeeled (Netherlands) (Prunus domestica)					110						18	HPLC	91	91	Hc
83	Plum, yellow (Mexico) (Spondias sp.)										1820	[p]	unknown	83	83	O
56	Pomegranate, fresh (Australia) (Punicia granatum)	pulp, seeds	57	76.2	50	40	0					11	OCC	72 1	72.1	Rk
84	Pomegranate (CIS) (Punicia granatum)	juice									0	[p]	unknown	84	84	-
70	Pomelo, raw (China) (Citrus maxima)		51	86.7							40 (tr-120)	0	OCC	70	70	Rn
45	Prickly pear, raw (USA) (Opuntia megacantha)	fruit			ND	51	12					10	HPLC	45	45	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
45	Prickly pear, raw (USA) (Opuntia megacantha)	fruit			ND	47	ND					8	HPLC	45	45	Hk
56	Prickly pear, fresh (Australia) (Opuntia ficus-indica)	pulp, seeds	78	83 9	20	30	10					8	OCC	72.1	72.1	Rk
83	Prickly pear, fresh (Mexico) (Opuntia sp)										60	[p]	unknown	83	83	O
84	Prune, raw (CIS) ()										60	[p]	unknown	84	84	-
85	Prune, dried (Croatia) ()										1530	[p]	OCC	85	85	Rn
45	Pummelo, raw Red and white (USA) (Citrus maxima)	fruit			14	320	103					64	HPLC	45	45	Hk
45	Pummelo, raw Red and white (USA) (Citrus maxima)	fruit			ND	ND	10					1	HPLC	45	45	Hk
84	Quince, raw (CIS) (Cydonia oblongo)										400	[p]	unknown	84	84	-
84	Quince (CIS) (Cydonia oblongo)	jam									0	[p]	unknown	84	84	-
84	Quince stewed (CIS) (Cydonia oblongo)										150	[p]	unknown	84	84	-
84	Quince (CIS) (Cydonia oblongo)	juice									10	[p]	unknown	84	84	-
96	Quince, raw, peeled (Australia) (Cydonia oblongo)				10	30	30					9	HPLC	96	96	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
84	Raisins, raw (CIS) ()										0	[p]	unknown	84	84	-
56	Rambutan, fresh red skin (Australia) (Nephelium lappaceum)	pulp	39	79 8	0	0	0					0	OCC	72 1	72 1	Rk
56	Rambutan, fresh yellow skin (Australia) (Nephelium lappaceum)	pulp	41	79.2	0	0	0					0	OCC	72.1	72 1	Rk
84	Raspberries, raw (CIS) (Rubus idaeus)										200	[p]	unknown	84	84	-
84	Raspberries (CIS) (Rubus idaeus)	jam									20	[p]	unknown	84	84	-
38	Raspberries, raw (Slovak republic) (Rubus idaeus)					73 (tr-17)					251 (160-329)	[p]	OCC	88	88	Rz
87	Raspberries, raw (New Zealand) (Rubus idaeus)				0	0						0	HPLC	87	87	Hn
87	Raspberries, canned (New Zealand) (Rubus idaeus)					0						0	HPLC	87	87	Hn
96	Raspberries, canned, drained (Australia) (Rubus idaeus)				18	tr	0					2	HPLC	96	96	Hn
96	Raspberries, canned (Australia) (Rubus idaeus)				7	tr	0					1	HPLC	96	96	Hn
88	Red currants, raw (Slovak republic) (Ribes rubrum)										112 (57-160)	[p]	OCC	88	88	Rz
45	Red raspberry, raw (USA) (Rubus spp)	fruit			24	2	ND					2	HPLC	45	45	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr ref	QM
45	Red raspberry, raw (USA) (Rubus spp)	fruit			25	ND	ND					2	HPLC	45	45	Hk
33	Rose hip Wild (Poland) (Rosa canina)	fruit (berries)				7210	1750	920	11120			1363	HPLC	nf	33	Hn
33	Rose hip Cultivated (Poland) (Rose rugosa)	fruit (berries)				1760	1910	430	4330			469	HPLC	nf	33	Hn
84	Rose hip (CIS) (Rose rugosa)	juice									800	[p]	unknown	84	84	-
84	Rose hip (CIS) (Rose rugosa)	puree									2600	[p]	unknown	84	84	-
84	Rose hip, drained (CIS) (Rose rugosa)										4900	[p]	unknown	84	84	-
88	Rose hip, raw (Slovak republic) (Rosa canina)										7100	[p]	OCC	88	88	Rz
91	Rose hip syrup (Netherlands) (Rosa canina)					70						12	HPLC	91	91	Hc
45	Sapote, Mamey, raw (USA) (Calocarpum sapota)	fruit			ND	69	ND					12	HPLC	45	45	Hk
45	Sapote, Mamey, raw (USA) (Calocarpum sapota)	fruit			ND	100	ND					17	HPLC	45	45	Hk
45	Sapote, black, raw (USA) (Diospyrous digyna)	fruit			ND	48	16					9	HPLC	45	45	Hk
45	Sapote, black, raw (USA) (Diospyrous digyna)	fruit			ND	59	110					20	HPLC	45	45	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext ref.	Chr. ref.	QM
45	Sapote, white, raw (USA) (Casimiroa edulis)	fruit			ND	90	34					18	HPLC	45	45	Hk
45	Sapote, white, raw (USA) (Casimiroa edulis)	fruit			ND	91	ND					15	HPLC	45	45	Hk
15	Satsumas (U.K.) (Citrus reticulata)	flesh	100	87.4	5	73	0					13	HPLC	77	77	Hk
84	Sea buckthorn, raw (CIS) (Hippophae rhamnoides)										1500	[p]	unknown	84	84	-
15	Sharonfruit (U.K.) (Diospyros kaki)	flesh	100	79.9	2	5	21					3	HPLC	77	77	Hk
88	Sour cherry, raw (Slovak republic) (Prunus cerasus)					241 (227-256)					592 (455-730)	[p]	OCC	88	88	Rz
84	Squash, sauce (CIS) (Cucurbita pepo)										130	[p]	unknown	84	84	-
84	Squash, raw (CIS) (Cucurbita pepo)										1500	[p]	unknown	84	84	-
6	Starfruit (Malaysia) (Averrhoa carambola)	fruit (mature)			0	28	1066	66				103	HPLC	71.1	06	Hk
26	Strawberries, raw (Egypt) (Fragaria vesca)				4	20						4	HPLC	74	74	Hk
27	Strawberries, raw (Spain) (Fragaria elatior)	fruit (ripe)	96	90.9		4		14		1		1	HPLC	74	01.2	Hc
30	Strawberries (USA) (Fragaria vesca)	fruit (ripe)				230		60				38	HPLC	30	30	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
70	Strawberries, raw (China) (Fragaria ananassa)		98	90.7							10	0	OCC	70	70	Rn
84	Strawberries, raw (CIS) (Fragaria vesca)										30	[p]	unknown	84	84	-
87	Strawberries, canned (New Zealand) (Fragaria spp)					3						1	HPLC	87	87	Hn
87	Strawberries, raw (New Zealand) (Fr chiloensis x virgiana)		93	89.4	0	6						1	HPLC	87	87	Hn
88	Strawberries, raw (Slovak republic) (Fragaria spp.)										52 (37-80)	[p]	OCC	88	88	Rz
96	Strawberries, canned, drained (Australia) (Fragaria spp)				0	11	0					2	HPLC	96	96	Hn
96	Strawberries, raw (Australia) (Fragaria spp)				10	20	0					4	HPLC	96	96	Hn
88	Sweet cherry, raw (Slovak republic) (Prunus avium)					35 (25-51)					314 (230-452)	[p]	OCC	88	88	Rz
45	Tamarillo, raw (USA) (Cyphomandra betacea)	fruit			ND	560	180					110	HPLC	45	45	Hk
45	Tamarillo, raw (USA) (Cyphomandra betacea)	fruit			ND	1000	430					206	HPLC	45	45	Hk
56	Tamarillo, fresh New Zealand grown (Australia) (Cyphomandra betacea)	pulp, seeds	94	86.2	10	400	1050					164	OCC	72 1	72.1	Rk
87	Tamarillo, raw , red (New Zealand) (Cyphomandra betacea)		76	86.1	10	600	1059					198	HPLC	87	87	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
87	Tamarillo, raw , yellow (New Zealand) (Cyphomandra betacea)			86 3		763						127	HPLC	87	87	Hn
96	Tangelo, raw, peeled (Australia) ()				10	290	NA					49	HPLC	96	96	Hn
36	Tangelo concentrate (USA) ()					160	230 [b]					48	HPLC	36	36	Hk
70	Tangerine, raw (China) (Citrus reticulata)		73	85.4							550	0	OCC	70	70	Rn
84	Tangerine, raw (CIS) (Citrus reticulata)										60	[p]	unknown	84	84	-
84	Tangerine (CIS) (Citrus reticulata)	juice/jams									30	[p]	unknown	84	84	-
36	Tangerine concentrate (USA) (Citrus reticulata)					180	230 [b]					51	HPLC	36	36	Hk
36	Tangor concentrate Murcott (USA) ()					490	310 [b]					110	HPLC	36	36	Hk
6	Tree tomato (Malaysia) (Cyphomandra betacea)	fruit (mature)			0	599	1236	0				214	HPLC	71 1	06	Hk
13	Tree tomato, raw (Brazil) (Cyphomandra betacea)	pulp (ripe)				790 (490-1180)	1390 (980-1820)	170 (100-250)		60 (20-110)		260	OCC	67	67	Rk
13	Tree tomato, raw (Brazil) (Cyphomandra betacea)	peel (ripe)				880 (620-1280)	1000 (680-1230)	150 (110-170)		110 (60-170)		239	OCC	67	67	Rk
70	Wampe, raw (China) (Clausena lansium)		45	82.6							0	0	OCC	70	70	Rn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
70	Wampee, mountain, raw (China) (Clausena excavata)		56	82.5							40	0	OCC	70	70	Rn
36	Watermelon, raw (USA) (Citrullus vulgaris)	fruit (ripe)				310						52	HPLC	36	36	Hk
27	Watermelon, raw (Spain) (Citrullus vulgaris)	fruit, peeled (ripe)	78	91.9		77	62	40	2454			19	HPLC	74	01.2	Hc
47	Watermelon (Vietnam) (Citrullus vulgaris)										5850	[p]	HPLC/OCC	71	71	Hn
84	Watermelon, raw (CIS) (Citrullus vulgaris)										100	[c]	unknown	84	84	-
94	Watermelon, raw (Australia) (Citrullus vulgaris)				0	190			5230			30	HPLC	94	94	Hc
6	Watermelon, red (Malaysia) (Citrullus vulgaris)	fruit (mature)			0	324	457	0	5301			103	HPLC	71.1	06	Hk
56	Wax jambu, fresh (Australia) (Syzygium samarangense)	whole fruit	90	90.3	0	0	0					0	OCC	72.1	72.1	Rk
11	West Indian cherry, raw (Brazil, Sao Pau) (Malpighia glabra)	fruit (ripe)			tr	400	50					[p]	OCC	67	67	Rk
11	West Indian cherry, raw (Brazil, Ceara) (Malpighia glabra)	fruit (ripe)			tr	2150	210					[p]	OCC	67	67	Rk
11	West Indian cherry, raw (Brazil, Pernamb) (Malpighia glabra)	fruit (ripe)			10	2580	360					[p]	OCC	67	67	Rk
54	West Indian cherry, raw (Brazil, Campina) (Malpighia glabra)	fruit			tr	340	40					60	OCC	67	67 4	Rk

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext ref.	Chr ref.	QM
70	Wolfberry, Chinese, raw (China) (Lycium chinensis)		100	72.2							8600	0	OCC	70	70	Pn

MEAT

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
91	Beef meat, lean, cooked (Netherlands) (Bos taurus)					0						0	HPLC	91	91	Hc
7	Beef, local (Malaysia) ()					10						2	HPLC	71.1	06	Hk
7	Chicken heart (Malaysia) (Gallus domesticus)					0						0	HPLC	71.1	06	Hk
7	Chicken burger (Malaysia) (Gallus domesticus)					4						1	HPLC	71.1	06	Hk
7	Chicken frankfurter (Malaysia) (Gallus domesticus)					1						0	HPLC	71.1	06	Hk
7	Chicken liver (Malaysia) (Gallus domesticus)					18						3	HPLC	71.1	06	Hk
7	Chicken thigh (Malaysia) (Gallus domesticus)					0						0	HPLC	71.1	06	Hk
91	Liver pate (Netherlands) ()					0						0	HPLC	91	91	Hc
7	Mutton, local (Malaysia) (Ovis aries)					0						0	HPLC	71.1	06	Hk
91	Pork meat, average, cooked (Netherlands) (Sus domesticus)					0						0	HPLC	91	91	Hc
91	Pork meat, fat, cooked (Netherlands) (Sus domesticus)					20						3	HPLC	91	91	Hc
91	Pork meat, lean, cooked (Netherlands) (Sus domesticus)					0						0	HPLC	91	91	Hc

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref	Chr. ref.	QM
25	Buriti fruit, raw (Brazil, Sao Lui) (Mauritia vinifera)	fruit, oil extr			0	304000						50667	OCC	25	36	Rz
25	Buriti sweet, raw (Brazil, Sao Lui) ()	fruit, oil extr			0	103000						17167	OCC	25	36	Rz
85	Carrot, oil, extract (Croatia) ()										1130000	[p]	OCC	85	85	Rn
85	Mayonnaise w. tomato (Croatia) ()					500					1320	[p]	OCC	85	85	Rn
47	Momoridica oil (Vietnam) (Momordica cochinchinensis)					71920					300000	[p]	HPLC/OCC	71	71	Hn
35	Olive oil, virgin Picual (Spain) (Olea europaea)					233		934				39	HPLC	39.1	35	Hk
35	Olive oil, virgin Picudo (Spain) (Olea europaea)					240		687				40	HPLC	39.1	35	Hk
35	Olive oil, virgin Subbetica (Spain) (Olea europaea)					223		526				37	HPLC	39.1	35	Hk
35	Olive oil, virgin Hojiblanca (Spain) (Olea europaea)					219		599				37	HPLC	39.1	35	Hk
35	Olive oil, virgin Pajarero (Spain) (Olea europaea)					108		178				18	HPLC	39.1	35	Hk
23	Palm oil, sterilized (Brazil, Una, Ba) (Elaeis oleifera)	ster. fruit oil			34160	40030	1350		tr	tr		9768	OCC	23	14 1	Rk
23	Palm oil, sterilized Psifera (Brazil, Una, Ba) (Elaeis guineensis)	ster. fruit oil			1440	8810	tr		450	tr		1594	OCC	23	14 1	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr. ref	QM
23	Palm oil, sterilized Dura dumpy (Brazil, Una, Ba) (Elaeis guineensis)	ster fruit oil			22840	25510	tr		2180	tr		6239	OCC	23	14.1	Rk
23	Palm oil, fresh Jacq tenera (Brazil, Una, Ba) (Elaeis guineensis)	fruit oil			16370	36260	tr		730	tr		7468	OCC	23	14 1	Rk
23	Palm oil, sterilized Jacq tenera (Brazil, Una, Ba) (Elaeis guineensis)	ster fruit oil			9410	22890	tr		930	tr		4634	OCC	23	14 1	Rk
23	Palm oil, fresh (Brazil, Una, Ba) (Elaeis oleifera)	fruit oil			42480	102610	3100		tr	tr		21083	OCC	23	14 1	Rk
23	Palm oil, fresh Psifera (Brazil, Una, Ba) (Elaeis guineensis)	fruit oil			1840	20210	tr		70	600		3528	OCC	23	14 1	Rk
23	Palm oil, fresh Dura dumpy (Brazil, Una, Ba) (Elaeis guineensis)	fruit oil			29560	57610	tr		1720	tr		12173	OCC	23	14 1	Rk
25	Red palm oil, raw (Brazil, Recife,) (Elaeis guineensis)	fruit, oil extr			13000	30000						6131	OCC	25	36	Rz

VEGETABLES

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
79	Agathi, raw (India) (Sesbania grandiflora)					15440						2573	HPLC	79		Hn
2	Amaranth (Guatemala) (Amaranthus caudatus)					6790						1132	HPLC	78	78.2	Hn
4	Amaranth, raw (Guatemala) (Amaranthus caudatus)	leaves (mature)		84.6		0						0	HPLC	71	75.1	Hk
9	Amaranth tiger spot red (Taiwan) (Amaranthus mangostanus)	(mature)									4350	[p]	OCC	71	71	Rk
9	Amaranth (Taiwan) (Amaranthus mangostanus)	(mature)									3090	[p]	OCC	71	71	Rk
9	Amaranth KY white (Taiwan) (Amaranthus mangostanus)	(mature)									2670	[p]	OCC	71	71	Rk
18	Amaranth, fresh (Haiti) (Amaranthus)			90.0	0	31650						5275	HPLC	74	-	Hn
18	Amaranth, solar dried (Haiti) (Amaranthus)			7.75	0	13033						2172	HPLC	74	-	Hn
79	Amaranth, raw (India) (Amaranthus gangeticus)					8340						1390	HPLC	79		Hn
80	Amaranth (Nepal) (Amaranthus leucocarpus)					4787						798	HPLC	80	80	Hn
86	Amaranth, boiled (Indonesia) (Amaranthus hibridus)	leaves				250						42	HPLC	86	86	Hn
86	Amaranth, boiled (Indonesia) (Amaranthus hibridus)	leaves			48	858						147	HPLC	86	86	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Met (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
86	Amaranth, dried (Indonesia) (Amaranthus hibridus)	leaves			715	10604						1830	HPLC	86	86	Hn
86	Amaranth, fresh (Indonesia) (Amaranthus hibridus)				59	1227						210	HPLC	86	86	Hn
70	Amaranth, Chinese, raw (China) (Amaranthus tricolor)		74	90.4							3035 (2240-4080)	0	OCC	70	70	Rn
52	Amaranth, green, raw (India) (Amaranthus gangeticus)					6688						1115	HPLC	52	52	Hk
70	Amaranth, green, slender, raw (China) (Amaranthus viridus)		61	90.2							2953 (1950-3710)	0	OCC	70	70	Rn
52	Amaranth, red, raw (India) (Amaranthus gangeticus)					7173						1196	HPLC	52	52	Hk
47	Amaranth, red (Vietnam) (Amaranthus gangeticus)					1910					5010	[p]	HPLC/OCC	71	71	Hn
70	Amaranth, red-purple, raw (China) (A caudatus atropurpureus)		55	88.3							2663 (1870-3590)	0	OCC	70	70	Rn
3	Amaranth, spineless (Thailand) (Amaranthus sp)		87	88.1		3352						559	HPLC	73	73	Hc
18	Amaranth, sun-dried, sun dried (Haiti) (Amaranthus)			7.27	0	10150						1692	HPLC	74	-	Hn
47	Amaranth, white (Vietnam) (Amaranthus tricolour)					330					4260	[p]	HPLC/OCC	71	71	Hn
40	Angled luffa, raw (Australia) (Luffa acutangula)	fruit (mature)	54		40	65	15					16	OCC	72.1	72.1	Rk

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
3	Angles gourd (Thailand) (Luffa acutangula)		78	94 5		1						0	HPLC	73	73	Hc
2	Apazote (Guatemala) (Chenopodium ambrosoides)					1800						300	HPLC	78	78 2	Hn
1	Artichoke, cooked (30 min) (Spain) (Cynara scolymus)	flower (mature)	47	89 4	ND	59	ND	275	ND			10	HPLC	74 2	01	Hb
1	Artichoke, raw (Spain) (Cynara scolymus)	flower (mature)	47	83.7	ND	47	ND	163	ND			8	HPLC	74.2	01	Hb
58	Artichoke, Jerusalem, fresh (Australia) (Helianthus tuberosus)	tuber	87	79.7	0	20	0 [a]					3	OCC	72.1	72 1	Rk
57	Artichoke, globe, fresh (Australia) (Cynara scolymus)	inner leaves	43	85 2	20	40	80 [a]					16	OCC	72.1	72.1	Rk
47	Ashgourd squash (Vietnam) (Benincasa cerifera)										60	[p]	HPLC/OCC	71	71	Hn
57	Asparagus, fresh green (Australia) (Asparagus officinalis)	stem	97	92 3	20	30	20					9	OCC	72 1	72.1	Rk
70	Asparagus, raw (China) (Asparagus officinalis)		55	94.0							730	0	OCC	70	70	Rn
84	Asparagus (China) (Asparagus officinalis)										30	[p]	unknown	84	84	-
87	Asparagus, raw (New Zealand) (Asparagus officinalis)		73	92.2	0	420						70	HPLC	87	87	Hn
87	Asparagus, canned (New Zealand) (Asparagus officinalis)			91.3		378						63	HPLC	87	87	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext ref	Chr ref	QM
80	Asparagus shoots (Nepal) (Asparagus officinalis)					129						22	HPLC	80	80	Hn
1	Asparagus, green, raw (Spain) (Asparagus officinalis)	stem (mature)	50	93.4	0	320	ND	609	ND			53	HPLC	74.2	01	Hb
1	Asparagus, green, cooked (25 min) (Spain) (Asparagus officinalis)	stem (mature)	50	92.2	ND	387	ND	738	ND			65	HPLC	74.2	01	Hb
34	Azalea (Japan) (Rhododendron indicum)	leaves				4322		4868			14360	[p]	HPLC	34	34	Hn
34	Azalea (Japan) (Rhododendron indicum)	leaves				4469		8513			20220	[p]	HPLC	34	34	Hn
79	Pacnhali, raw (India) (Basella rubra)					2840						473	HPLC	79		Hn
3	Bai cha-plu (Thailand) (Piper sarmentosum)		57	79.8		2455						409	HPLC	73	73	Hc
3	Bai ka-sung (Thailand) (Perperomia pellucida)		69	73.4		1713						286	HPLC	73	73	Hc
3	Bai kra-prao, red (Thailand) (Ocimum sanctum)		38	86.8		6803						1134	HPLC	73	73	Hc
3	Bai kra-prao, white (Thailand) (Ocimum sp.)		30	37.9		4344						724	HPLC	73	73	Hc
7	Baked beans, canned (Malaysia) ()					127						21	HPLC	71.1	06	Hk
47	Balm-mint (Vietnam) (Perilla ocymoides)					2710					6220	[p]	HPLC/OCC	71	71	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Hst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
3	Bamboo shoot (Thailand) (Bambusa sp.)		46	91.9		0						0	HPLC	73	73	Hc
70	Bamboo shoots, raw winter (China) (Phyllostachys edulis)	shoots	39								80	0	OCC	70	70	Rn
3	Banana (Thailand) (Musa sapientum)	flower	43	91.3		109						18	HPLC	73	73	Hc
3	Banana (Thailand) (Musa sapientum)	stem	84	96 3		0						0	HPLC	73	73	Hc
3	Banana Ta-nee (Thailand) (Musa sapientum)		87	90.2		44						7	HPLC	73	73	Hc
3	Banana Kai (Thailand) (Musa sapientum)		85	75.4		345						58	HPLC	73	73	Hc
3	Banana Nam-wa (Thailand) (Musa sapientum)		89	68.6		131						22	HPLC	73	73	Hc
3	Banana E-tor (Thailand) (Musa sapientum)		64	73.9		17						3	HPLC	73	73	Hc
3	Basil (Thailand) (Ocimum canu	leaves	72	88.1		3543						591	HPLC	73	73	Hc
9	Basil (Taiwan) (Ocimum basilicum)	(mature)									4908	[p]	OCC	71	71	Rk
40	Bean sprouts, raw (Australia) (Vigna radiata)	seed (mature)	100		10	10	10					3	OCC	72.1	72.1	Rk
84	Beans, raw (CIS) ()										400	[p]	unknown	84	84	-

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext ref.	Chr. ref.	QM
84	Beans, preserved (CIS) ()										300	[p]	unknown	84	84	-
77	Beansprouts, mung, boiled [f] (U K) (Phaseolus aureus)		100	91.6	23	23	23					8	HPLC	77	67	Hk
77	Beansprouts, mung, raw (U K) (Phaseolus aureus)		100	90.4	20	20	20					7	HPLC	77	67	Hk
47	Beans, black (Vietnam) (Vigna cylindrica)										100	[p]	HPLC/OCC	71	71	Hn
59	Beans, broad, fresh broad (Australia) (Vicia faba)	seed	40	76.0	10	190	20 [a]					34	OCC	72.1	72.1	Rk
70	Beans, broad, raw (China) (Vicia faba)	sprouts	80								30	0	OCC	70	70	Rn
70	Beans, broad, raw (China) (Vicia faba)		30								110	0	OCC	70	70	Rn
87	Beans, broad, uncooked (New Zealand) (Vicia faba)		100	78.7	0	195						33	HPLC	87	87	Hn
87	Beans, broad, boiled (New Zealand) (Vicia faba)			78.8		176						29	HPLC	87	87	Hn
5[illegible]	Beans, butter, fresh butter (Australia) (Phaseolus lunatus)	seed, pod	96	91.6	50	60	10					15	OCC	72.1	72.1	Rk
1	Beans, green, cooked (35 min) (Spain) (Phaseolus vulgaris)	seed, pod (mature)	93	93.4	79	238	ND	487	ND			47	HPLC	74.2	01	Hb
1	Beans, green, raw (Spain) (Phaseolus vulgaris)	seed, pod (mature)	93	90.9	35	166	ND	365	ND			31	HPLC	74.2	01	Hb

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
42	Beans, green, boiled (9 min) (USA) (Phaseolus vulgaris)	(mature)				540		610				90	HPLC	42	42	Hb
42	Beans, green, raw (USA) (Phaseolus vulgaris)	(mature)				470		590				78	HPLC	42	42	Hb
26	Beans, green, raw (Egypt) (Phaseolus vulgaris)				55	331						60	HPLC	74	74	Hk
70	Beans, green, raw (China) (Phaseolus vulgaris)		94								304	0	OCC	70	70	Rn
84	Beans, green, raw (CIS) (Phaseolus vulgaris)										50	[p]	unknown	84	84	-
87	Beans, green, raw (New Zealand) (Phaseolus vulgaris)		83	90.7	0	382						64	HPLC	87	87	Hn
87	Beans, green, frozen, uncooked (New Zealand) (Phaseolus vulgaris)		100	90.2	0	382						64	HPLC	87	87	Hn
87	Beans, green, boiled (New Zealand) (Phaseolus vulgaris)			91 0		344						57	HPLC	87	87	Hn
96	Beans, green, boiled (Australia) (Phaseolus vulgaris)				70	390	70					78	HPLC	96	96	Hn
96	Beans, green, raw (Australia) (Phaseolus vulgaris)				50	310	60					62	HPLC	96	96	Hn
59	Beans, purple, fresh purple (Australia) (Phaseolus vulgaris)	seed, pod	81	87.5	30	50	10					12	OCC	72.1	72.1	Rk
59	Beans, red, fresh red (Australia) (Phaseolus vulgaris)	seed	38	61.6	30	20	10					7	OCC	72.1	72.1	Rk

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
1	Beet, raw leaf type (Spain) (Beta vulgaris)	stalk, leaves (mature)	88	93.4	ND	1095	ND	1503	ND			183	HPLC	74 2	01	Hb
2	Beet (Guatemala) (Beta vulgaris)					5730						955	HPLC	78	78 2	Hn
1	Beet, cooked (35 min) (Spain) (Beta vulgaris)	stalk, leaf (mature)	88	95.1	ND	1360	ND	1960	ND			227	HPLC	74 2	01	Hb
70	Beet, raw (China) (Beta spp)	greens	90	94.2							1910	0	OCC	70	70	Rn
82	Beet, fresh (Egypt) (Beta vulgaris)										tr	[p]	OCC	71	71	Rn
84	Beet root, raw (CIS) (Beta vulgaris)										10	[p]	unknown	84	84	-
84	Beet root (CIS) (Beta vulgaris)	juice									0	[p]	unknown	84	84	-
84	Beet root, drained (CIS) (Beta vulgaris)										40	[p]	unknown	84	84	-
58	Beetroot, fresh (Australia) (Beta vulgaris)	root	43	85.7	20	10	0					3	OCC	72.1	72 1	Rk
85	Beetroot, raw (Croatia) (Beta vulgaris)										600	[p]	OCC	85	85	Rn
91	Beetroot, cooked (Netherlands) (Beta vulgaris)					0						0	HPLC	91	91	Hc
70	Beet, common garden, raw (China) (Beta vulgaris)	root	76								10	0	OCC	70	70	Rn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
10	Beldroega, raw (Brazil) (Portulaca oleracea)	leaves (mature)				3000				70	8900	500	OCC	67	67.7	Rk
2	Bell tree dahlia (Guatemala) (Dahlia imperialis)					9060						1510	HPLC	78	78.2	Hn
4	Bell tree dahlia, raw (Guatemala) (Dahlia imperialis)	leaves (mature)		89.4		1300						217	HPLC	71	75.1	Hk
4	Bell tree dahlia, cooked (Guatemala) (Dahlia imperialis)	leaves (mature)		87.8		8900						1483	HPLC	71	75.1	Hk
79	Betle leaf, raw (India) (Piper betle)					5880						980	HPLC	79		Hn
9	Bitter gourd KY No. 2 (Taiwan) (Momordica charantia)	leaves (mature)									12858	[p]	OCC	71	71	Rk
9	Bitter gourd moon shine (Taiwan) (Momordica charantia)	(mature)									90	[p]	OCC	71	71	Rk
9	Bitter gourd KY No. 6 (Taiwan) (Momordica charantia)	(mature)									126	[p]	OCC	71	71	Rk
9	Bitter gourd KY No 2 (Taiwan) (Momordica charantia)	(mature)									138	[p]	OCC	71	71	Rk
31	Bitter gourd, cooked (Pakistan) (Momordica charantia)					2210						368	OCC	71.4	71 1	Rz
31	Bitter gourd, raw (Pakistan) (Momordica charantia)					2840						473	OCC	71.4	71.1	Rz
80	Bitter gourd (Nepal) (Momordica charatia)					67						11	HPLC	80	80	Hn

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext ref.	Chr. ref.	QM
40	Bitter melon, raw (Australia) (Momordica charantia)	fruit (mature)	84		30	40	10					10	OCC	72.1	72 1	Rk
70	Bitter-gourd, raw (China) (Momordica charantia)		85	94.2							52 (20-90)	0	OCC	70	70	Rn
79	Botlabenda, raw (India) (Abutilon indicum)					1250						208	HPLC	79		Hn
3	Bottle gourd (Thailand) (Lagenaria siceraria)	fruit	97	94.6		2						0	HPLC	73	73	Hc
9	Bottle gourd (Taiwan) (Lagenaria siceraria)	(mature)									222	[p]	OCC	71	71	Rk
70	Bottle-gourd, raw (China) (Lagenaria siceraria)		90	95.0							28 (0-70)	0	OCC	70	70	Rn
31	Brinjal, raw (Pakistan) (Solanum melongena)					1640						273	OCC	71.4	71 1	Rz
31	Brinjal, cooked (Pakistan) (Solanum melongena)					1020						170	OCC	71.4	71.1	Rz
80	Brinjal (Nepal) (Solenum melongena)					8						1	HPLC	80	80	Hn
77	Broad beans, boiled [g] (U K) (Vicia faba)	whole, no pods	100	82.8	8	142	0					24	HPLC	77	67	Hk
77	Broad beans, raw (U K) (Vicia faba)	whole, no pods	23	80.3	9	165	0					28	HPLC	77	67	Hk
90	Broad beans, fresh (Ethiopia) (Vicia faba)					890						148	Spectr.	90	90	O

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext ref	Chr ref	QM
90	Broad beans, roasted, boiled (Ethiopia) (Vicia faba)					100						17	Spectr	90	90	O
90	Broad beans, germinated (Ethiopia) (Vicia faba)					160						27	Spectr	90	90	O
9	Broccoli (Taiwan) (Brassica oleracea)	(mature)									540	[p]	OCr	71	71	Rk
42	Broccoli, steamed Botrytis (USA) (Brassica oleracea)	(mature)				2760		3250				460	HPLC	42	42	Hb
42	Broccoli, raw Botrytis (USA) (Brassica oleracea)	(mature)				2330		2830				388	HPLC	42	42	Hb
80	Broccoli (Nepal) (B oleracea Italica)					630						105	HPLC	80	80	Hn
94	Broccoli, raw (Australia) (B oleracea italica)				0	860			< 30			140	HPLC	94	94	Hc
96	Broccoli, raw (Australia) (Brassica oleracea)				0	380	20					65	HPLC	96	96	Hn
1	Brussels sprouts, raw leaf type (Spain) (Brassica oleracea)	leaves (mature)	80	83.8	ND	77	ND	185	ND			13	HPLC	74 2	01	Hb
1	Brussels sprouts, cooked (25 min) leaf type (Spain) (Brassica oleracea)	leaves (mature)	80	82.8	ND	162	ND	468	ND			27	HPLC	74 2	01	Hb
30	Brussels sprouts, cooked (USA) (Brassica oleracea)	leaves (mature)				450		1290				75	HPLC	30	30	Hk
84	Brussels sprouts, raw (CIS) (Brassica oleracea)										300	[p]	unknown	84	84	-

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
91	Brussels sprouts, cooked (Netherlands) (B oleracea gemnifera)					150						25	HPLC	91	91	Hc
96	Brussels sprouts, raw (Australia) (B oleracea gemnifera)				0	160	20					29	HPLC	96	96	Hn
80	Buckweat leaves (Nepal) (Fagopyrum esculentum)					1864						311	HPLC	80	80	Hn
3	Bug hua-ling (Thailand) ()		89	86.9		292						49	HPLC	73	73	Hc
3	Bug noi (Thailand) ()		88	96.2		203						34	HPLC	73	73	Hc
79	Bunkuntikura, raw (India) ()					410						68	HPLC	79		Hn
70	Burclover, raw (China) (Medicago polymorpha)		68	87.5							3480	0	OCC	70	70	Rn
3	Cabbage common (Thailand) (Brassica oleracea)		87	93.1		46						8	HPLC	73	73	Hc
1	Cabbage, raw (Spain) (Brassica oleracea)	leaves (mature)	81	89.0	ND	22	ND	59	ND	6		4	HPLC	74 2	01	Hb
1	Cabbage, cooked (25 min) (Spain) (Brassica oleracea)	leaves (mature)	81	90.8	ND	33	ND	93	ND	6		6	HPLC	74.2	01	Hb
9	Cabbage (Taiwan) (Brassica oleracea)	(mature)									138	[p]	OCC	71	71	Rk
31	Cabbage, raw (Pakistan) (Brassica oleracea)					160						27	OCC	71.4	71 1	Rz

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
31	Cabbage, cooked (Pakistan) (Brassica oleracea)					90						15	OCC	71 4	71.1	Rz
34	Cabbage (Japan) (Brassica oleracea)	leaves				3099		6285			17313	[p]	HPLC	34	34	Hn
82	Cabbage, fresh (Egypt) (Brassica oleracea)										75	[p]	OCC	71	71	Rn
80	Cabbage (Nepal) (B. oleracea)					54						9	HPLC	80	80	Hn
90	Cabbage, raw (Ethiopia) (Brassica spp)					40						7	Spectr	90	90	O
70	Cabbage, common, raw (China) (B oleracea capitata)		88	93.8							190 (tr-420)	0	OCC	70	70	Rn
96	Cabbage, common, raw (Australia) (B oleracea capitata)				0	38	0					6	HPLC	96	96	Hn
1	Cabbage, red, raw (Spain) (Brassica oleracea)	leaves (mature)	81	88.2	ND	3	0	8	ND	tr		1	HPLC	74 2	01	Hb
1	Cabbage, red, cooked (38 min) (Spain) (Brassica oleracea)	leaves (mature)	81	91.3	ND	7	0	23	ND	4		1	HPLC	74.2	01	Hb
84	Cabbage, red, raw (CIS) (Brassica oleracea)										100	[p]	unknown	84	84	-
96	Cabbage, red, raw (Australia) (Brassica oleracea)				0	10	0					2	HPLC	96	96	Hn
96	Cabbage, savoy, raw (Australia) (Brassica oleracea)				0	80	0					13	HPLC	96	96	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
84	Cabbage, white raw (CIS) (Brassica oleracea)										20	[p]	unknown	84	84	-
84	Cabbage, white, cooked (CIS) (Brassica oleracea)										160	[p]	unknown	84	84	-
84	Cabbage, white, pickled, cooked (CIS) (Brassica oleracea)										160	[p]	unknown	84	84	-
96	Cabbage, white, raw (Australia) (Brassica oleracea)				0	10	0					2	HPLC	96	96	Hn
36	Cantaloupe, raw (USA) (Cucumis melo)	fruit (ripe)				1510						252	HPLC	36	36	Hk
79	Capsicum, raw (India) (Capsicum spp)					140						23	HPLC	79		Hn
59	Capsicum, sweet pepper, fresh red, Long Red Cayenne (Australia) (Capsicum annuum grossum)	pulp, skin	74	91.1	10	320	2280					264	OCC	72.1	72.1	Rk
59	Capsicum, sweet pepper, fresh banana (Australia) (Capsicum annuum grossum)	pulp, skin	78	92.3	10	100	240					40	OCC	72 1	72.1	Rk
59	Capsicum, sweet pepper, fresh continental (Australia) (Capsicum annuum grossum)	pulp, skin	89	93.8	0	10	10					3	OCC	72.1	72.1	Rk
59	Capsicum, sweet pepper, fresh green (Australia) (Capsicum annuum grossum)	pulp, skin	71	93.7	30	160	20					31	OCC	72 1	72.1	Rk
3	Carambola (Thailand) (Averrhoa carambola)		87	93.5		19						3	HPLC	73	73	Hc
1	Carrot, cooked (33 min) (Spain) (Daucus carota)	root (mature)	85	89.7	3245	8162	ND	273	ND			1643	HPLC	74.2	01	Hb

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
2	Carrot (Guatemala) (Daucus carot' sativa)					11810		0				1968	HPLC	78	78.2	Hn
1	Carrot, raw (Spain) (Daucus carota)	root (mature)	85	88.1	2895	6628	ND	288	ND			1357	HPLC	74.2	01	Hb
6	Carrot (Malaysia) (Daucus carota)				3410	6769	0	0	0			1425	HPLC	71.1	06	Hk
8	Carrot (Malaysia) (Daucus carota)	root (mature)			3410	6770		0				1425	HPLC	71.3	06	Hk
9	Carrot Tung tans (Taiwan) (Daucus carota)	(mature)									4878	[p]	OCC	71	71	Rk
9	Carrot Ideal (Taiwan) (Daucus carota)	(mature)									5628	[p]	OCC	71	71	Rk
9	Carrot Bata Ill (Taiwan) (Daucus carota)	(mature)									10746	[p]	OCC	71	71	Rk
9	Carrot (Taiwan) (Daucus carota)	(mature)									9438	[p]	OCC	71	71	Rk
18	Carrot, dried (Mali) (Daucus carota)			10.3	10100	14300						3262	HPLC	74	-	Hn
20	Carrot, raw Nantes (Brazil) (Daucus carota)				3205	4795						1078	HPLC	67	67.2	Rk
18	Carrot, sun-dried (Haiti) (Daucus carota)			10.1	15250	26533						5749	HPLC	74	-	Hn
18	Carrot, fresh (Haiti) (Daucus carota)			91.0	35833	64350						13842	HPLC	74	-	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
31	Carrot, raw (Pakistan) (Daucus carota)	red part				4830						805	OCC	71.4	71.1	Rz
31	Carrot, cooked (Pakistan) (Daucus carota)	white part				2910						485	OCC	71.4	71.1	Rz
31	Carrot, cooked (Pakistan) (Daucus carota)	red part				1960						327	OCC	71.4	71.1	Rz
31	Carrot, raw (Pakistan) (Daucus carota)	white part				4370						728	OCC	71.4	71.1	Rz
34	Carrot (Japan) (Daucus carota)	leaves				3383		2097			7435	[p]	HPLC	34	34	Hn
26	Carrot, raw (Egypt) (Daucus carota)				3415	6319						1350	HPLC	74	74	Hk
47	Carrot (Vietnam) (Daucus carota)				1920	3230					6940	[p]	HPLC/OCC	71	71	Hn
58	Carrot, fresh large (mature) (Australia) (Daucus carota)	root (mature)	90	88.5	3930	8260	250					1742	OCC	72.1	72.1	Rk
52	Carrot, raw (India) (Daucus carota)					1611						269	HPLC	52	52	Hk
58	Carrot, fresh small (baby) (Australia) (Daucus carota)	root (young)	90	88.4	4800	720	260					562	OCC	72.1	72.1	Rk
70	Carrot, raw (China) (Daucus carota sativus)	greens	93	90.2							2000	0	OCC	70	70	Rn
80	Carrot (Nepal) (Daucus carota)					4276						713	HPLC	80	80	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
79	Carrot, raw (India) (Daucus carota)					6460						1077	HPLC	79		Hn
85	Carrot, raw (Croatia) (Daucus carota)				3410	9090					12500	[p]	OCC	85	85	Rn
90	Carrot, boiled (Ethiopia) (Daucus carota)					1150						192	Spectr.	90	90	O
91	Carrot, raw (Netherlands) (Daucus carota)					1870						312	HPLC	91	91	Hc
90	Carrot, fried (Ethiopia) (Daucus carota)					2850						475	Spectr	90	90	O
91	Carrot, cooked (Netherlands) (Daucus carota)					2700						450	HPLC	91	91	Hc
87	Carrot, boiled (New Zealand) (Daucus carota)			90.9		8010						1335	HPLC	87	87	Hn
87	Carrot, canned (New Zealand) (Daucus carota)					8010						1335	HPLC	87	87	Hn
87	Carrot, uncooked, Red Chantenay (New Zealand) (Daucus carota)		100	91.1		8900						1483	HPLC	87	87	Hn
87	Carrot, raw (New Zealand) (Daucus carota)			87.1		8900						1483	HPLC	87	87	Hn
94	Carrot, raw (Australia) (Daucus carota)				3480	6030			< 30			1290	HPLC	94	94	Hc
85	Carrots, canned (Croatia) (Daucus carota)				2970	5480					8500	[p]	OCC	85	85	Rn

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref	QM
84	Carrot, red (CIS) (Daucus carota)	juice									1600	[p]	unknown	84	[illegible]	-
84	Carrot, red, pickled (CIS) (Daucus carota)										7000	[p]	unknown	84	84	-
84	Carrot, red, raw (CIS) (Daucus carota)										9100	[p]	unknown	84	84	-
84	Carrot, red, preserves (CIS) (Daucus carota)										5400	[p]	unknown	84	84	-
84	Carrot, yellow, raw (CIS) (Daucus carota)										1100	[p]	unknown	84	84	-
70	Carrot, yellow, orange, raw (China) (Daucus carota sativus)	root	90								2340	0	OCC	70	70	Rn
10	Caruru, raw (Brazil) (Amaranthus viridis)	leaves (mature)				11000				820	40000	1833	OCC	67	67 7	Rk
6	Cashew leaves (Malaysia) (Anacardium occidentale)	(mature)			0	1342	0	773	0			224	HPLC	71.1	06	Hk
3	Cassava (Thailand) (Manihot esculenta)	leaves	74	75.6		8067						1345	HPLC	73	73	Hc
48	Cassava TMS 71693 (Australia) (Manihot esculenta)	tuber			16	190		60				33	HPLC	48	01.1	Hk
48	Cassava TMS 71673 (Australia) (Manihot esculenta)	tuber			2	14		5				3	HPLC	48	01.1	Hk
48	Cassava V-2 (Nigeria) (Manihot esculenta)	tuber			10	300	24	30				54	HPLC	48	01.1	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
48	Cassava M Aus 10 (Australia) (Manihot esculenta)	tuber			1	20	2	30				4	HPLC	48	01.1	Hk
48	Cassava SM-150 (Australia) (Manihot esculenta)	tuber			6	80		60				14	HPLC	48	01 1	Hk
58	Cassava, fresh yellow flesh (Australia) (Manihot esculenta)	tuber	95	65.7	60	730	20					129	OCC	72.1	72.1	Rk
58	Cassava, fresh white flesh (Australia) (Manihot esculenta)	tuber	93	58.4	20	30	10					8	OCC	72 1	72.1	Rk
66	Cassava, fresh 'exotic lines' (India) (Manihot esculenta)	flesh				209						35	OCC	71	71	Rk
66	Cassava, fresh 'indigenous lines' (India) (Manihot esculenta)	flesh				206						34	OCC	71	71	Rk
86	Cassava, boiled (Indonesia) (Manihot utilissima)	leaves			95	3431						580	HPLC	86	86	Hn
86	Cassava, dried (Indonesia) (Manihot utilissima)	leaves			1344	26880						4597	HPLC	86	86	Hn
86	Cassava, boiled (Indonesia) (Manihot utilissima)	leaves			48	1216						207	HPLC	86	86	Hn
86	Cassava, fresh (Indonesia) (Manihot utilissima)	leaves			112	6272						1055	HPLC	86	86	Hn
9	Cassava, leaf (Taiwan) (Manihot esculenta)	leaves (mature)									9480	[p]	OCC	71	71	Rk
92	Cassave, yellow, processed BB3 (Ghana) (Manihot esculenta)					10						2	HPLC	92	92	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lute n (range)	Lycopene (range)	Zeaxanti (range)	Total (range)	RE	Princ method	Ext ref.	Chr. ref.	QM
92	Cassave, yellow 0-100A (Colombia) (Manihot esculenta)					580						97	HPLC	92	92	Rk
92	Cassave, yellow Yellow heart (small) (Jamaica) (Manihot esculenta)					290						48	HPLC	92	92	Rk
92	Cassave, yellow 0-799 (Colombia) (Manihot esculenta)					1050						175	HPLC	92	92	Rk
92	Cassave, yellow 0-137 (Colombia) (Manihot esculenta)					100						17	HPLC	92	92	Rk
92	Cassave, yellow, processed BB3 (Ghana) (Manihot esculenta)					70						12	HPLC	92	92	Rk
92	Cassave yellow M col 1816 (Colombia) (Manihot esculenta)					170						28	HPLC	92	92	Rk
92	Cassave, yellow Yellow heart (large) (Jamaica) (Manihot esculenta)					1130						188	HPLC	92	92	Rk
3	Cassia (Thailand) (Cassia siamea)	flower	71	74.6		tr						0	HPLC	73	73	Hc
70	Cattail, raw (China) (Typha spp.)		12	95.0							10	0	OCC	70	70	Rn
1	Cauliflower, cooked (30 min) (Spain) (Brassica oleracea)	flower (mature)	84	92.5	ND	7	ND	15	ND	tr		1	HPLC	74.2	01	Hb
1	Cauliflower, raw (Spain) (Brassica oleracea)	flower (mature)	84	91.1	ND	2	ND	4	ND			0	HPLC	74.2	01	Hb
3	Cauliflower (Thailand) (Brassica oleracea)		65	91.6		32						5	HPLC	73	73	Hc

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref	Chr. ref.	QM
9	Cauliflower (Taiwan) (Brassica oleracea)	(mature)									18	[p]	OCC	71	71	Rk
31	Cauliflower, cooked (Pakistan) (Brassica oleracea)					20						3	OCC	71 4	71 1	Rz
31	Cauliflower, raw (Pakistan) (Brassica oleracea)					30						5	OCC	71.4	71.1	Rz
70	Cauliflower, raw (China) (B oleracea botrytis)		74	92.3							63 (30-80)	0	OCC	70	70	Rn
80	Cauliflower (Nepal) (B. oleracea botrytis)					16						3	HPLC	80	80	Hn
82	Cauliflower, fresh (Egypt) (Brassica oleracea)										tr	[p]	OCC	71	71	Rn
84	Cauliflower, drained (CIS) (Brassica oleracea)										200	[p]	unknown	84	84	-
84	Cauliflower, raw (CIS) (Brassica oleracea)										20	[p]	unknown	84	84	-
96	Cauliflower, raw (Australia) ()				0	10	0					2	HPLC	96	96	Hn
80	Cauliflower, mature (Nepal) (B oleracea botrysis)	leaves				2640						440	HPLC	80	80	Hn
80	Cauliflower, tender (Nepal) (B. oleracea botrysis)	leaves				1647						2745	HPLC	80	80	Hn
70	Cedar, raw (China) (Toona sinensis)	shoots	93	82.5							1145 (930-1360)	0	OCC	70	70	Rn

Carotenoid content of food (µg/100g edible portion, fresh weight)

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6	Cekur manis (Malaysia) (Sauropus androgynus)				0	13351	0	29913	0			2225	HPLC	71.1	06	Hk
58	Celeriac, fresh (Australia) (Apium graveolens rapaceum)	root	78	86.6	10	10	10					3	OCC	72.1	72.1	Rk
84	Celeriac, raw (CIS) (Apium graveolens rapaceum)	root									10	[p]	unknown	84	84	-
3	Celery (Thailand) (Apium graveolens)		57	88.0		1381						230	HPLC	73	73	Hc
9	Celery golden medium (Taiwan) (Apium graveolens)	(mature)									3120	[p]	OCC	71	71	Rk
9	Celery cresson (Taiwan) (Apium graveolens)	(mature)									1596	[p]	OCC	71	71	Rk
9	Celery white stem (Taiwan) (Apium graveolens)	(mature)									2076	[p]	OCC	71	71	Rk
44	Celery (Hungary) (Apium graveolens)	stem				15450						2575	HPLC	44	44	Hk
57	Celery, fresh (Australia) (Apium graveolens dulce)	stem	79	95.1	0	40	0					7	OCC	72.1	72.1	Pk
70	Celery, raw (China) (Apium graveolens)	stem	71	92.7							120 (40-370)	0	OCC	70	70	Rn
82	Celery, fresh (Egypt) (Allium graveolens)	leaves									27500	[p]	OCC	71	71	Rn
82	Celery, fresh (Egypt) (Allium graveolens)	stems									6750	[p]	OCC	71	71	Rn

Carotenoid content of food (µg/100g edible portion, fresh weight)

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84	Celery, raw (CIS) (Allium graveolens)										4500	[p]	unknown	84	84	-
70	Celtuce, raw (China) (Lactuca sativa)	leaves	100	92 9							1378 (500-2140)	0	OCC	70	70	Rn
6	Cemperai (Malaysia) (Champereia griffithii)				3677	3218	0	9871	0			856	HPLC	71.1	06	Hk
79	Ceylon bachhali, raw (India) (Talinum triangulare)					2900						483	HPLC	79		Hn
6	Ceylon spinach (Malaysia) (Basella rubra)				0	3533	0	1299	0			589	HPLC	71.1	06	Hk
3	Chan (Thailand) ()	fruit	62	80.3		50						8	HPLC	73	73	Hc
82	Chard, fresh (Egypt) (Beta vulgaris)										10000	[p]	OCC	71	71	Rn
2	Chard, Swiss (Guatemala) (Beta vulgaris cicla)					1760						293	HPLC	78	78 2	Hn
70	Chard, Swiss, raw (China) (Beta vulgaris)		100	94.2							935 (570-1880)	0	OCC	70	70	Rn
70	Chard, Swiss, pale green, raw (China) (Beta vulgaris)		90								820	0	OCC	70	70	Rn
70	Chard, Swiss, purple, raw (China) (Beta vulgaris)		95	95.0							1010	0	OCC	70	70	Rn
70	Chard, Swiss, white, raw (China) (Beta vulgaris)		95	94.4							1880	0	OCC	70	70	Rn

Carotenoid content of food (µg/100g edible portion, fresh weight)

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52	Chavli, raw (India) (Vigina catjang)					6448						1075	HPLC	52	52	Hk
2	Chayote (Guatemala) (Sechium edule)					3000						500	HPLC	78	78 2	Hn
9	Chayote (Taiwan) (Sechium edule)	fruit (mature)									0	[p]	OCC	71	71	Rk
9	Chayote (Taiwan) (Sechium edule)	leaves (mature)									2496	[p]	OCC	71	71	Rk
3	Cha-om (Thailand) (Leucaena glauca)		58	80.8		1679						280	HPLC	73	73	Hc
79	Chennangiaku, raw (India) (Cassia spp.)					1190						198	HPLC	79		Hn
34	Cherry (Japan) (Prunus yedoensis)	leaves				7734		7563			21424	[p]	HPLC	34	34	Hn
9	Cherry radish (Taiwan) (Raphanus sativus)	(mature)									48	[p]	OCC	71	71	Rk
9	Cherry radish JSA 20 days (Taiwan) (Raphanus sativus)	leaves (mature)									2946	[p]	OCC	71	71	Rk
9	Cherry radish Chingan 20 days (Taiwan) (Raphanus sativus)	(mature)									54	[p]	OCC	71	71	Rk
90	Chick pea, boiled (Ethiopia) (Cicer arietinum)					450						75	Spectr.	90	90	O
90	Chick pea, roasted (Ethiopia) (Cicer arietinum)					420						70	Spectr.	90	90	O

Carotenoid content of food (µg/100g edible portion, fresh weight)

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90	Chick pea, fresh (Ethiopia) (Cicer arietinum)					450						75	Spectr.	90	90	O
3	Chickpeas (Thailand) ()		92	86.4		100						17	HPLC	73	73	Hc
9	Chicory (Taiwan) (Cichorium endivia)	leaves (mature)									570	[p]	OCC	71	71	Rk
57	Chicory, fresh long green (Australia) (Cichorium intybus)	leaves	80	93.6	30	220	30					42	OCC	72 1	72.1	Rk
82	Chicory, fresh (Egypt) (Cichorum intybus)										650	[p]	OCC	71	71	Rn
91	Chicory, cooked (Netherlands) (Cichorium intybus)					0						0	HPLC	91	91	Hc
47	Chili (Vietnam) (Capsicum annuum)										3400	[p]	HPLC/OCC	71	71	Hn
85	Chil paste, dried (Mexico) (Capsicum annum longum)										27460	[p]	unknown	83	83	O
3	Chili pepper (Thailand) (Capsicum annuum)		94	85.4		186						31	HPLC	73	73	Hc
3	Chili pepper, dried (Thailand) (Capsicum pubesescens)		86	10.9		8290						1382	HPLC	73	73	Hc
3	Chili pepper, green (Thailand) (Capsicum annuum)		97	-		387						65	HPLC	73	73	Hc
6	Chili pepper, green (Malaysia) (Capsicum annuum)				0	468	0	386	0			78	HPLC	71.1	06	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

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3	Chili pepper, red (Thailand) (Capsicum annuum)		85	83.0		934						156	HPLC	73	73	Hc
[illegible]	Chili pepper, small (Thailand) (Capsicum pubesescens)		90	80 2		844						141	HPLC	73	73	Hc
3	Chili pepper, yellow (Thailand) (Capsicum frutescens)		95	-		932						155	HPLC	73	73	Hc
59	Chili, hot pepper, fresh red (Australia) (Capsicum annuum longum)	whole fruit	99	8[illegible].7	60	1370	780					305	OCC	72.1	72.1	Rk
59	Chili, hot pepper, fresh green (Australia) (Capsicum annuum longum)	whole fruit	92	80.9	30	140	100					35	OCC	72 1	72 1	Rk
59	Chili, hot pepper, fresh banana (Australia) (Capsicum annuum longum)	pulp, skin	87	90.0	20	40	20					10	OCC	72.1	72 1	Rk
31	Chili, large, cooked (Pakistan) (Capsicum annuum)					1530						255	OCC	71 4	71.1	Rz
31	Chili, large, raw (Pakistan) (Capsicum annuum)					2020						337	OCC	71 4	71.1	Rz
6	Chili, red (Malaysia) (Capsicum annuum)				0	1663	1754	941	0			439	HPLC	71.1	06	Hk
[illegible]	Chili, green, raw (India) (Capsicum annuum)					1010						168	HPLC	79		Hn
80	Chilli, green (Nepal) (Capsicum annum grossa)					78						13	HPLC	80	80	Hn
80	Chilli, red, dried (Nepal) (Capsicum annum grossa)					4228						705	HPLC	80	80	Hn

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext ref.	Chr. ref	QM
3	Chinese cabbage (Thailand) (Brassica sinensis)	flower	78	93.7		1306						218	HPLC	73	73	Hc
3	Chinese cabbage (Thailand) (Brassica Chinensis)		72	92.4		2339						390	HPLC	73	73	Hc
6	Chinese cabbage (Malaysia) (Brassica chinensis)				0	3022	0	963	0			504	HPLC	71.1	06	Hk
9	Chinese cabbage (Taiwan) (Brassica campestris)	(mature)									54	[p]	OCC	71	71	Rk
40	Chinese cabbage, raw (Australia) (Brassica pekinensis)	leaf, stem (mature)	92		0	190	0					32	OCC	72.1	72.1	Rk
47	Chinese cabbage (Vietnam) (Brassica sinensis)										2440	[p]	HPLC/OCC	71	71	Hn
70	Chinese cabbage, raw flowering stalk type (China) (Brassica spp)		89	94.0							850 (340-1360)	0	OCC	70	70	Rn
70	Chinese cabbage, raw flat type (China) (B chinensis rosularis)		88	92.0							3065 (2630-3500)	0	OCC	70	70	Rn
70	Chinese cabbage, raw petiole, white stem (China) (B chinensis communis)		90	94.0							1880	0	OCC	70	70	Rn
70	Chinese cabbage, raw head-forming type (China) (Brassica pekinensis)		99	93.9							2230 (1490-2950)	0	OCC	70	70	Rn
70	Chinese cabbage, raw head forming type (China) (Brassica pekinensis)		86	94.4							1910 (100-3720)	0	OCC	70	70	Rn
70	Chinese cabbage, raw petiole type (China) (Brassica chinensis)		90	94.2							823 (tr-1300)	0	OCC	70	70	Rn

Carotenoid content of food (µg/100g edible portion, fresh weight)

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86	Chinese cabbage, stewed (Indonesia) (Brassica sp)	leaves				953						159	HPLC	86	86	Hn
86	Chinese cabbage, fresh (Indonesia) (Brassica sp)				36	953						162	HPLC	86	86	Hn
86	Chinese cabbage, dried (Indonesia) (B ssica sp)	leaves			1144	8960						1593	HPLC	86	86	Hn
70	Chinese cabbage, purple, raw flowering stalk type (China) (B campestris purpurea)		70	92.3							880	0	OCC	70	70	Rn
70	Chinese cabbage, purple, raw flowering stalk type (China) (B campestris purpurea)	leaves	55	92.9							970	0	OCC	70	70	Rn
47	Chinese celery (Vietnam) (Apium graveolens)										1740	[p]	HPLC/OCC	71	71	Hn
6	Chinese chives (Malaysia) (Allium odorum)				0	3509	0	1083	0			585	HPLC	71 1	06	Hk
40	Chinese chives, raw (Australia) (Allium tuberosum)	leaves (mature)	97		15	3260	150 [a]					558	OCC	72 1	72.1	Rk
40	Chinese flowering cabbag, raw (Australia) (Brassica parachinensis)	leaf, stem (mature)	94		15	1360	20					230	OCC	72 1	72 1	Rk
3	Chinese kale (Thailand) (Brassica alboglabra)		65	90.5		1121						187	HPLC	73	73	Hc
6	Chinese kale (Malaysia) (Brassica alboglabra)				0	4092	0	1540	0			682	HPLC	71 1	06	Hk
3	Chinese leek (Thailand) (Allium adorum)	leaves	80	89.5		820						137	HPLC	73	73	Hc

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr ref.	QM
3	Chinese leek (Thailand) (Allium adorum)		81	92 6		615						103	HPLC	73	73	Hc
3	Chinese leek (Thailand) (Allium adorum)	flower	60	89 6		917						153	HPLC	73	73	Hc
9	Chinese leek flower leek (Taiwan) (Allium odorum)	(mature)									2058	[p]	OCC	71	71	Rk
9	Chinese leek (Taiwan) (Allium odorum)	(mature)									1938	[p]	OCC	71	71	Rk
6	Chinese mustard leaves (Malaysia) (Brassica juncea)				0	2928	0	1019	0			488	HPLC	71.1	06	Hk
40	Chinese spinach, raw (Australia) (Amaranthus tricolor)	leaf, stem (mature)	89		210	1710	100					312	OCC	72.1	72 1	Rk
3	Chinese swamp cabbage (Thailand) (Ipomoea aquatica)		68	92.0		2521						420	HPLC	73	73	Hc
40	Chinese white cabbage, raw (Australia) (Brassica chinensis)	leaf, stem (mature)	98		10	490	20					84	OCC	72.1	72.1	Rk
9	Ching chiang paitsai Chang-hi (Taiwan) (Brassica campestris)	(mature)									1788	[p]	OCC	71	71	Rk
9	Ching chiang paitsai (Taiwan) (Brassica campestris)	(mature)									1836	[p]	OCC	71	71	Rk
9	Ching chiang paitsai KY No 1 (Taiwan) (Brassica campestris)	(mature)									2358	[p]	OCC	71	71	Rk
2	Chipilin (Guatemala) (Crotalaria longirostrata)					11220		0				1870	HPLC	78	78.2	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
79	Chirrakura, raw (India) ()					7140						1190	HPLC	79		Hn
79	Chitramulam, raw (India) (Plumbago zeylanica)					3890						648	HPLC	79		Hn
2	Chives (Guatemala) (Allium schoenoprasum)					2270						378	HPLC	78	78.2	Hn
58	Chives, fresh (Australia) (Allium schoenoprasum)	stem	100	89.6	30	2230	110					384	OCC	72.1	72 1	Rk
70	Chives, chinese, raw (China) (Allium spp.)		94	91.7							2291 (1110-3210)	0	OCC	70	70	Rn
59	Cholo, fresh (Australia) (Sechium edule)	pulp	84	94.3	40	20	20					9	OCC	72.1	72.1	Rk
2	Chomtee (Guatemala) (Lycianthes synanthera)					8130						1355	HPLC	78	78.2	Hn
80	Cho-cho marrow (Nepal) (Sochium edule)					3						1	HPLC	80	80	Hn
47	Chrysanthemum (Vietnam) (Chrysanthemum coronarium)					230					1600	[p]	HPLC/OCC	71	71	Hn
70	Chrysanthemum, raw (China) (Chrysanthemum coronarium)		38	94.8							1798 (1290-2540)	0	OCC	70	70	Rn
79	Chukka, raw (India) (Rumex vesicarius)					2800						467	HPLC	79		Hn
5	Clover, cooked (British Columbi) (Trifolium wormskioldii)	rhizomes (mature)		81		2						0	HPLC	76.1	76	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr. ref.	QM
3	Coconut (Thailand) (Cocos nucifera)	top stem	100	87 0		0						0	HPLC	73	73	Hc
52	Colocasia, black, raw (India) (Colacasia antiquosum)					9111						1519	HPLC	52	52	Hk
52	Colocasia, green, raw (India) (Colacasia antiquosum)					9081						1514	HPLC	52	52	Hk
31	Colbash, cooked (Pakistan) (Legenaria vulgaris)					1050						175	OCC	71 4	71 1	Rz
31	Colbash, raw (Pakistan) (Legenaria vulgaris)					1580						263	OCC	71.4	71 1	Rz
31	Colocasia, raw (Pakistan) (Colocasia esculenta)					1360						227	OCC	71.4	71 1	Rz
31	Colocasia, cooked (Pakistan) (Colocasia esculenta)					910						152	OCC	71.4	71.1	Rz
79	Colocasia, raw (India) (Colocasia antiquorum)					5920						986	HPLC	79		Hn
3	Coral (Thailand) (Erythrina fusca)	leaves	40	-		131						22	HPLC	73	73	Hc
2	Coriander (Guatemala) (Coriandrum sativum)					8780						1463	HPLC	78	78.2	Hn
3	Coriander (Thailand) (Coriandrum sativum)		64	88.5		895						149	HPLC	73	73	Hc
4	Coriander, raw (Guatemala) (Coriandrum sativum)	leaves (mature)		91.1		3900						650	HPLC	71	75 1	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext ref	Chr ref	QM
4	Coriander, cooked (Guatemala) (Coriandrum sativum)	leaves (mature)		79 3		20000						3333	HPLC	71	75 1	Hk
9	Coriander (Taiwan) (Coriandrum sativum)	(mature)									3168	[p]	OCC	71	71	Rk
47	Coriander (Vietnam) (Coriandrum sativum)										3290	[p]	HPLC, OCC	71	71	Hn
52	Coriander, raw (India) (Coriandrum sativum)					5699						950	HPLC	52	52	Hk
70	Coriander, raw (China) (Coriandrum sativum)		85	88.3							3770	0	OCC	70	70	Fr
79	Coriander, raw (India) (Coriandrum sativum)					4800						800	HPLC	79		Hn
83	Coriander (Mexico) (Coriandrum sativum)										4310	[p]	unknown	83	83	O
6	Coriander leaves (Malaysia) (Coriandrum sativum)				0	3167	0	1339	0			528	HPLC	71 1	06	Hk
3	Corn, raw (Thailand) (Zea mays)		21	77.4		11						2	HPLC	73	73	Hc
87	Corn, sweet, canned (New Zealand) (Zea mays)					158						26	HPLC	87	87	Hn
87	Corn, sweet, frozen, uncooked (New Zealand) (Zea mays)		100	76.5	0	176						29	HPLC	87	87	Hn
87	Corn, sweet, boiled (New Zealand) (Zea mays)					158						26	HPLC	87	87	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Dist (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr. ref.	QM
87	Corn, sweet, on cob, raw (New Zealand) (Zea mays)		40	68.0	0	176						29	HPLC	87	87	Hn
84	Corn, yellow, preserved (CIS) (Zea mays)										20	[p]	unknown	84	84	-
9	Cowpea (Taiwan) (Vigna unguiculata)	(mature)									114	[p]	OCC	71	71	Rk
47	Cowpea (Vietnam) (Vigna sinensis)										310	[p]	HPLC/OCC	71	71	Hn
70	Cowpeas, raw (China) (Vigna unguiculata)		95								890	0	OCC	70	70	Rn
70	Cowpeas, raw variegated (China) (Vigna unguiculata)		95								240	0	OCC	70	70	Rn
70	Cowpeas, yardlong, raw long, pale green (China) (V unguiculata sesquip.)		98								120	0	OCC	70	70	Rn
5	Cow-parsnip, raw (British Columbi) (Heracleum lanatum)	budstalks (raw) (mature)		95		3						1	HPLC	76.1	76	Hk
3	Crataeva (pak kum) (Thailand) ()		77	75.9		764						127	HPLC	73	73	Hc
3	Cucumber (Thailand) (Cucumis sativus)		92	94.9		51						9	HPLC	73	73	Hc
1	Cucumber (Spain) (Cucumis sativa)	pulp, seeds (mature)	70	95.7	ND	11	ND	16	ND			2	HPLC	74.2	01	Hb
9	Cucumber (Taiwan) (Cucumis sativa)	(mature)									222	[p]	OCC	71	71	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr ref	QM
44	Cucumber (Hungary) (Cucumis sativa)					1150						192	HPLC	44	44	Hk
59	Cucumber, fresh Lebanese, Dominus (Australia) (Cucumis sativa)	whole fruit	100	95.1	20	130	20					25	OCC	72 1	72 1	Rk
59	Cucumber, fresh green, peeled (Australia) (Cucumis sativa)	pulp, seeds	82	96.2	20	20	10					6	OCC	72 1	72.1	Rk
59	Cucumber, fresh telegraph (Australia) (Cucumis sativa)	whole fruit	100	96.3	10	150	20					28	OCC	72 1	72.1	Rk
59	Cucumber, fresh green (Australia) (Cucumis sativa)	whole fruit	100	95.5	20	250	20					45	OCC	72 1	72 1	Rk
59	Cucumber, fresh apple, Crystal Salad (Australia) (Cucumis sativa)	whole fruit	100	95.2	30	20	0					6	OCC	72 1	72 1	Rk
70	Cucumber, raw prickly-skinned (China) (Cucumis sativa)		86	96.2							60	0	OCC	70	70	Rn
70	Cucumber, raw smooth-skinned (China) (Cucumis sativa anglicus)		73	94.3							168 (80-500)	0	OCC	70	70	Rn
70	Cucumber, raw prickly-skinned (China) (Cucumis sativa)		86	96.9							130	0	OCC	70	70	Rn
70	Cucumber, raw (China) (Cucumis sativa)		89	96.2							146 (tr-420)	0	OCC	70	70	Rn
84	Cucumber forcing-bed (CIS) (Cucumis sativa)										20	[p]	unknown	84	84	-
84	Cucumber soil (CIS) (Cucumis sativa)										60	[p]	unknown	84	84	-

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref	QM
84	Cucumber, pickled (CIS) (Cucumis sativa)										30	[p]	unknown	84	84	-
91	Cucumber, raw (Netherlands) (Cucumis sativus)					0						0	HPLC	91	91	Hc
3	Cucumber, bitter (Thailand) (Momordica charantia)	leaves	56	86.6		3668						611	HPLC	73	73	Hc
3	Cucumber, bitter (Thailand) (Momordica charantia)		89	91.4		24						4	HPLC	73	73	Hc
3	Cucumber, large (Thailand) (Cucumis stivus)		86	96.0		3						1	HPLC	73	73	Hc
80	Curli doek (Nepal) (Rumex crispus)					1445						241	HPLC	80	80	Hn
77	Curly kale (U K) (B oleracea acephala)	no ribs/stalks	85	88.4	0	3130	32					525	HPLC	77	67	Hk
79	Curry leaf, raw (India) (Murraya koenigii)	leaves				7110						1185	HPLC	79		Hn
6	Curry leaves (Malaysia) (Murray koenigii)				0	9328	0	5252	0			1555	HPLC	71 1	06	Hk
3	Custard apple (Thailand) (Annona squamosa)		62	74.6		0						0	HPLC	73	73	Hc
84	Damsons (CIS) ()										4200	[p]	unknown	84	84	-
6	Daun Mengkudu (Malaysia) (Moringa citrifolia)				0	3108	0	8842	0			518	HPLC	71 1	06	Hk

Carotenoid content of food (μg/100g edible portion, fresh weight)

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8	Daun kelor (Malaysia) (Sauropus androgynus)	leaves (mature)			0	13400		29900				2233	HPLC	71 3	06	Hk
47	Dill (Vietnam) (Anethum graveolens)										3380	[p]	HPLC/OCC	71	71	Hn
84	Dill (CIS) (Anethum graveolens)										1000	[p]	unknown	84	84	-
47	Dismanthus (Vietnam) (Neptunia oleracea)										3550	[p]	HPLC/OCC	71	71	Hn
79	Drumstick, raw (India) (Moringa oleifera)					19690						3282	HPLC	79		Hn
6	Drumstick leaves (Malaysia) (Moringa oleifera)				0	7536	0	7128	0			1256	HPLC	71.1	06	Hk
8	Drumstick leaves (Malaysia) (Moringa oleifera)	leaves (mature)			0	7540		7130				1257	HPLC	71.3	06	Hk
79	Duggal kura, raw (India) (Amaranthus viridus)					710						118	HPLC	79		Hn
79	Dusudutega, raw (India) (Cocculus hirsutus)					530						88	HPLC	79		Hn
3	Egg plant, big (Thailand) (Solanum xanthocarpum)		89	90.2		35						6	HPLC	73	73	Hc
3	Egg plant, small (Thailand) (Solanum torvum sw.)		89	82.8		103						17	HPLC	73	73	Hc
9	Eggplant (Taiwan) (Solanum melongena)	(mature)									36	[p]	OCC	71	71	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext ref	Chr ref	QM
59	Eggplant, fresh (Australia) (S melongena esculentum)	whole fruit	84	92 4	30	20	0					6	OCC	72 1	72 1	Rk
70	Eggplant, raw (China) (Solanum melongena)		96	93.6							40 (30-50)	0	OCC	70	70	Rn
84	Eggplant 'caviar' (CIS) (Solanum melongena)										920	[p]	unknown	84	84	-
84	Eggplant, raw (CIS) (Solanum melongena)										20	[p]	unknown	84	84	-
70	Eggplant, purple, raw (China) (Solanum melongena)		96	93.3							33 (30-40)	0	OCC	70	70	Rn
57	Endive, fresh green curled (Australia) (Cichorium endivia)	leaves	71	94.3	20	420	20					74	OCC	72 1	72 1	Rk
91	Endive, cooked (Netherlands) (Cichorum endivia)					740						123	HPLC	91	91	Hc
91	Endive, raw (Netherlands) (Cichorum endivia)					1290						215	HPLC	91	91	Hc
9	Fennel (Taiwan) (Foeniculum vulgare)	root (mature)									198	[p]	OCC	71	71	Rk
9	Fennel (Taiwan) (Foeniculum vulgare)	stem (mature)									420	[p]	OCC	71	71	Rk
57	Fennel, fresh (Australia) (Foeniculum vulgare dulce)	inner stems	56	92.9	0	0	0					0	OCC	72.1	72 1	Rk
70	Fennel, raw (China) (Foeniculum vulgare)		90	91.8							3513 (1430-6500)	0	OCC	70	70	Rn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext ref	Chr ref	QM
79	Fenugreek, raw (India) (Trigonella foenum-graecum)					9100						1517	HPLC	79		Hn
90	Fenugreek, flour (Ethiopia) (Trigonella foenum graecum)					1230						205	Spectr	90	90	O
90	Fenugreek, porridge (Ethiopia) (Trigonella foerum graecum)					780						130	Spectr	90	90	O
6	Fern shoots (Malaysia) (Diplazium esculentum)				0	1438	0	1002	0			240	HPLC	71 1	06	Hk
80	Fern shoots (Nepal) (Dryopteris sp)					565						94	HPLC	80	80	Hn
2	Fernaldia (Guatemala) (Fernaldia pandurata)					580						97	HPLC	78	78 2	Hn
3	Fig (Thailand) (Ficus carica)		89	86.0		7						1	HPLC	73	73	Hc
5	Fireweed, raw (British Columbi) (Epilobium angustifolium)	shoots (peeled) (mature)		92		23						4	HPLC	76.1	76	Hk
6	Four-angled bean (Malaysia) (Psophocarpus tetragon.)				0	476	0	142	0			79	HPLC	71.1	06	Hk
6	French bean (Malaysia) (Phaseolus vulgaris)				0	236	0	460	0			39	HPLC	71.1	C6	Hk
8	French bean (Malaysia) (Phaseolus vulgaris)	(mature)			0	236		460				39	HPLC	71 3	06	Hk
86	French bean, dried (Indonesia) (Phaseolus vulgaris)	leaves				167						28	HPLC	86	86	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α carot (range)	β carot (range)	β crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref	Chr ref.	QM
86	French bean, boiled (Indonesia) (Phaseolus vulgaris)	leaves				71						12	HPLC	86	86	Hn
86	French bean, boiled (Indonesia) (Phaseolus vulgaris)	leaves				48						8	HPLC	86	86	Hn
86	French bean, fresh (Indonesia) (Phaseolus vulgaris)					48						8	HPLC	86	86	Hn
91	French bean, canned (Netherlands) (Phaseolus vulgaris)					40						7	HPLC	91	91	Hc
91	French bean, cooked (Netherlands) (Phaseolus vulgaris)					200						33	HPLC	91	91	Hc
94	French bean, raw (Australia) (Phaseolus vulgaris)				30	120			< 30			20	HPLC	94	94	Hc
3	Galangal (Thailand) (Alpinia galanga)	leaves	46	93.8		45						8	HPLC	73	73	Hc
3	Galangal (Thailand) (Alpinia galanga)	flower	42	84.6		92						15	HPLC	73	73	Hc
3	Galangal (Thailand) (Alpinia galanga)		83	83.0		14						2	HPLC	73	73	Hc
31	Gand gobhi, cooked (Pakistan) (Brassica oleracea)					50						8	OCC	71 4	71 1	Rz
31	Gand gobhi, raw (Pakistan) (Brassica oleracea)					100						17	OCC	71 4	71 1	Rz
79	Ganijeraku, raw (India) ()					1010						168	HPLC	79		Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext ref	Chr ref.	QM
80	Garden cress (Nepal) (Lepidium sativum)					5839						973	HPLC	80	80	Hn
9	Garland chrysanthemum tiger ear white (Taiwan) (Chrysanthemum coronarium)	(mature)									2106	[p]	OCC	71	71	Rk
9	Garland chrysanthemum (Taiwan) (Chrysanthemum coronarium)	(mature)									2106	[p]	OCC	71	71	Rk
40	Garland chrysanthemum, raw (Australia) (Chrysanthemum coronarium)	leaf, stem (mature)	92		20	1440	55					247	OCC	72 1	72 1	Rk
3	Garlic (Thailand) (Allium sativum)	leaves	90	89.9		1428						238	HPLC	73	73	Hc
3	Garlic (Thailand) (Allium porrum)	stem	90	83.5		0						0	HPLC	73	73	Hc
9	Garlic (Taiwan) (Allium sativum)	(mature)									684	[p]	OCC	71	71	Rk
58	Garlic, fresh (Australia) (Allium sativum)	bulb	83	59.9	0	10	0					2	OCC	72.1	72 1	Rk
70	Garlic, raw (China) (Allium sativum)		66	89.7							1155 (960-1350)	0	OCC	70	70	Rn
91	Gherkins (Netherlands) (Cucumis sativa)					160						27	HPLC	91	91	Hc
24	Giant swamp taro, raw (South Pacific I) (Cyrtosperma chamissonis)	root				27						5	HPLC	24	24	Hk
24	Giant swamp taro, raw (South Pacific I) (Cyrtosperma chamissonis)	root				22						4	HPLC	24	24	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext ref	Chr ref	QM
24	Giant taro, raw (South Pacific I) (Alocasia macrorrhiza)	root				0						0	HPLC	24	24	Hk
24	Giant taro, raw (South Pacific I) (Alocasia macrorrhiza)	root				0						0	HPLC	24	24	Hk
90	Gibto, raw (Ethiopia) (Lupinus termis)					200						33	Spectr	90	90	O
3	Ginger (Thailand) (Zingiber officinale)	leaves	38	85.4		1583						264	HPLC	73	73	Hc
9	Ginger (Taiwan) (Zingiber officinale)	(mature)									354	[p]	OCC	71	71	Rk
58	Ginger, fresh (Australia) (Zingiber officinale)	root	94	90.4	10	30	0					6	OCC	72.1	72.1	Rk
70	Ginger, raw (China) (Zingibar officinale)	rhizome (immature)	99								60	0	OCC	70	70	Rn
70	Ginger, raw (China) (Zingibar officinale)	rhizome (mature)	87								270	0	OCC	70	70	Rn
3	Goa bean (Thailand) (Psophocarpus tetragon.)	young pod	92	91.7		1139						190	HPLC	73	73	Hc
86	Goa beans, fresh (Indonesia) (Psophocarpus tetragonolob)					36						6	HPLC	86	86	Hn
86	Goa beans, dried (Indonesia) (Psophocarpus tetragonolob)	leaves				238						40	HPLC	86	86	Hn
86	Goa beans, boiled (Indonesia) (Psophocarpus tetragonolob)	leaves				16						3	HPLC	86	86	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref	Chr. ref	QM
86	Goa beans, steamed (Indonesia) (Psophocarpus tetragonolob)	leaves				95						16	HPLC	86	86	Hn
79	Gogu, raw (India) (Hibiscus sabdariffa)					6970						1162	HPLC	79		Hn
79	Golimittikura, raw (India) ()					1830						305	HPLC	79		Hn
85	Grass, green, fresh (Croatia) ()					7500					36000	[p]	OCC	85	85	Rn
9	Great burdock (Taiwan) (Arctium Lappa)	root (mature)									198	[p]	OCC	71	71	Rk
9	Great burdock (Taiwan) (Arctium Lappa)	stem (mature)									168	[p]	OCC	71	71	Rk
9	Great burdock (Taiwan) (Arctium Lappa)	leaves (mature)									6210	[p]	OCC	71	71	Rk
77	Green beans, boiled [g] (U K) (Phaseolus vulgaris)	pods and beans	100	91.0	39	310	0					55	HPLC	77	67	Hk
77	Green beans, raw (U K) (Phaseolus vulgaris)	pods and beans	83	90 7	39	310	0					55	HPLC	77	67	Hk
91	Green cabbage, cooked (Netherlands) (Brassica oleracea)					210						35	HPLC	91	91	Hc
41	Guku, raw (Zimbabwe) (Bidens pilosa)	leaves				19900						3317	OCC	41	41	Rk
41	Guku, raw (Zimbabwe) (Bidens pilosa)	leaves (mature)				32300						5383	OCC	41	41	Rk

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr ref.	QM
79	Gunagukura, raw (India) (Celos a argentae)					280						47	HPLC	79		Hn
40	Hairy melon, raw (Australia) (Benincasa hispida)	fruit (small) (mature)	98		0	20	0					3	OCC	72.1	72.1	Rk
79	Harichandamkura, raw (India) ()					7050						1175	HPLC	79		Hn
3	Hed mun-pu (Thailand) ()		100	87.5		82						14	HPLC	73	73	Hc
43	Helencha sak, raw leafy type (Bangladesh) (Enhydra fluctuans)					8200 (7950-8660)						1367	OCC	43	43	Rk
47	Herbaceous plant (edible (Vietram) (Blumea myriocephala)										4910	[p]	HPLC/OCC	71	71	Hn
9	Hibiscus (edible) (Taiwan) ()	(mature)									8286	[p]	OCC	71	71	Rk
3	Hog plum (Thailand) (Spodias spp.)	leaves	48	78.5		1231						205	HPLC	73	73	Hc
3	Hoo-saew (Thailand) ()	leaves	75	94.5		1143						191	HPLC	73	73	Hc
3	Horse radish (Thailand) (Moringa oleifera)	leaves	22	84.^		5452						909	HPLC	73	73	Hc
3	Horse radish (Thailand) (Moringa pterygosperma)	pod	51	88.0		114						19	HPLC	73	73	Hc
83	Huazontle (Mexico) (Chenopodium nutalliae)										770	[p]	unknown	83	83	O

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	PE	Princ method	Ext. ref	Chr. ref.	QM
70	Hyacinth-bean, raw (China) (Lablab purpurus)		92								320	0	OCC	70	70	Rn
70	Hyacinth-bean, raw pale green (China) (Lablab purpurus)		93								237	0	OCC	70	70	Rn
86	Indian mulberry, fresh (Indonesia) (Morinda citrifolia)	leaves			119	3479						590	HPLC	86	86	Hn
86	Indian mulberry, steamed (Indonesia) (Morinda citrifolia)	leaves			143	1549						271	HPLC	86	86	Hn
86	Indian mulberry, boiled (Indonesia) (Morinda citrifolia)	leaves				298						50	HPLC	86	86	Hn
86	Indian mulberry, dried (Indonesia) (Morinda citrifolia)	leaves			1280	11413						2014	HPLC	86	86	Hn
3	Indian mulbery (Thailand) (Modinda citrifolia)	leaves	79	78.7		2446						408	HPLC	73	73	Hc
3	Indian penny wort (Thailand) (Centella asiatica)	leaves	77	88.5		1422						237	HPLC	73	73	Hc
80	Indian spinach (Nepal) (Basella rubra)					879						147	HPLC	80	80	Hn
9	Ipil Ipil (Taiwan) (Leucaena leucocephala)	leaves (mature)									6198	[p]	OCC	71	71	Rk
3	Ivygourd (Thailand) (Coccinia indica)		55	90.7		4187						698	HPLC	73	73	Hc
3	Jackfruit (Thailand) (Artocarpus)	(unripe)	47	87.1		tr						0	HPLC	73	73	Hc

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext ref	Chr. ref.	QM
9	Japanese hone wort (Taiwan) (Cryptotaenia japonia)	(mature)									4266	[p]	OCC	71	71	Rk
47	Jute (potherbs) (Vietnam) (Corchorus olitorius)										6080	[p]	HPLC/OCC	71	71	Hn
43	Kachu sak, raw leafy type (Bangladesh) (Colocasia antiquorum)					8000 (7040-9760)						1333	OCC	43	43	Rk
3	Kaffer lime (Thailand) (Citrus hystrix)	leaves	50	66.4		1321						220	HPLC	73	73	Hc
9	Kale round (Taiwan) (Brassica oleracea)	(mature)									4770	[p]	OCC	71	71	Rk
9	Kale golden (Taiwan) (Brassica oleracea)	(mature)									1566	[p]	OCC	71	71	Rk
9	Kale (Taiwan) (Brassica oleracea)	(mature)									2346	[p]	OCC	71	71	Rk
20	Kale, raw (Brazil) (Brassica oleracea)					3105						513	HPLC	67	67.2	Rk
17	Kale (Brazil) (Brassica oleracea)					3040				440	9680	507	OCC	67	67.5	Rk
30	Kale, cooked (USA) (Brassica oleracea)	leaves (mature)				12600		25600				2100	HPLC	30	30	Hk
64	Kale, fresh 'winter' (Brazil) (B oleracea acephala)	leaves (mature)	100	-		5700				250	19100	[p]	OCC	67	67.8	Rk
64	Kale, fresh 'summer' (Brazil) (B oleracea acephala)	leaves (mature)	100	-		5050				200	17150	[p]	OCC	67	67.8	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext ref	Cir. ref.	QM
70	Kale, Chinese, raw (China) (Brassica alboglabra)		R	89.1							2335 (1270-3400)	0	OCC	70	70	Rn
90	Kale, Ethiopian, boiled (Ethiopia) (Brassica carinata)					11250						1875	Spectr	90	90	O
43	Kalmi sak, raw leafy type (Bangladesh) (Ipomoea reptans)					8300 (6700-9690)						1383	OCC	43	43	Rk
9	Kang kong white cane H K (Taiwan) (Ipomoea aquatica)	(mature)									2178	[p]	OCC	71	71	Rk
9	Kang kong large leaf (Taiwan) (Ipomoea aquatica)	(mature)									2736	[p]	OCC	71	71	Rk
9	Kang kong improved (Taiwan) (Ipomoea aquatica)	(mature)									2616	[p]	OCC	71	71	Rk
9	Kang kong (Taiwan) (Ipomoea aquatica)	(mature)									2838	[p]	OCC	71	71	Rk
91	Kapucijner pea, canned (Netherlands) (Pisum sativum)					0						0	HPLC	91	91	Hc
47	Kidney bean (Vietnam) (Phaseolus vulgaris)				30	110					310	[p]	HPLC/OCC	71	71	Hn
52	Knol-Khol, raw (India) (Brassica oleracea)	leaves				3526						588	HPLC	52	52	Hk
9	Kohlrabi (Taiwan) (Brassica oleracea)	(mature)									48	[p]	OCC	71	71	Rk
47	Kohlrabi (Vietnam) (Brassica oleracea)										20	[p]	HPLC/OCC	71	71	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr. ref.	QM
70	Kohlrabi, raw (China) (B oleracea gongylodes)	leaves		88.0							4790	0	OCC	70	70	Rn
70	Kohlrabi, raw (China) (B oleracea gongylodes)	stem	89								56	0	OCC	70	70	Rn
84	Kohlrabi, raw (CIS) (Brassica oleracea)										100	[p]	unknown	84	84	-
79	Koyyala koora, raw (India) (Suaeda moroica)					4900						817	HPLC	79		Hn
3	Kra jew (Thailand) ()	flower	60	92.3		51						9	HPLC	73	73	Hc
87	Kumara, microwaved (New Zealand) (Ipomoea batatas)			66.8		103						17	HPLC	87	87	Hn
87	Kumara, baked (New Zealand) (Ipomoea batatas)			66.4		138						23	HPLC	87	87	Hn
87	Kumara, raw (New Zealand) (Ipomoea batatas)		82	71.6		118						20	HPLC	87	87	Hn
87	Kumara, boiled (New Zealand) (Ipomoea batatas)	flesh		77.8		70						12	HPLC	87	87	Hn
87	Kumara, roasted (New Zealand) (Ipomoea batatas)			68.5		50						8	HPLC	87	87	Hn
47	La lot (Vietnam) (Piper lolot)										3500	[p]	HPLC/OCC	71	71	Hn
80	Ladies finger (Nepal) (Abelmoschus officinalis)					89						15	HPLC	80	80	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

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31	Lady's fingers, raw (Pakistan) (Hibiscus esculentus)					160						27	OCC	71.4	71.1	Rz
31	Lady's fingers, cooked (Pakistan) (Hibiscus esculentus)					80						13	OCC	71.4	71.1	Rz
43	Lal sak, cooked [e] leafy type (Bangladesh) (Amaranthus gangeticus)					21500						3583	OCC	43	43	Rk
43	Lal sak, raw leafy type (Bangladesh) (Amaranthus gangeticus)					8000 (6640-9260)						1333	OCC	43	43	Rk
5	Lambsquarters, raw (British Columbi) (Chenopodium album)	leaves		88		3840						640	HPLC	76.1	76	Hk
80	Lamb's quarter (Nepal) (Chenopodium album)					3334						556	HPLC	80	80	Hn
43	Lau sak, raw leafy type (Bangladesh) (Lagenaria vulgaris)					6600 (6200-6940)						1100	OCC	43	43	Rk
43	Lau sak, cooked leafy type (Bangladesh) (Lagenaria vulgaris)					7721						1287	OCC	43	43	Rk
3	Lead tree (Thailand) (Leucaena glauca)	tender top	61	79.8		449						75	HPLC	73	73	Hc
3	Lead tree (Thailand) (Leucaena glauca)	leaves	58	77.4		2763						461	HPLC	73	73	Hc
9	Leaf beet (Taiwan) (Beta vulgaris)	(mature)									978	[p]	OCC	71	71	Rk
34	Leaf mustard (Japan) (Brassica juncea)	leaves				4416		7178			21753	[p]	HPLC	34	34	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

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47	Leek (Vietnam) (Allium porrum)										470	[p]	HPLC/OCC	71	71	Hn
58	Leek, fresh 'Elephant' (Australia) (Allium ampeloprasm porrum)	bulb, stem	83	89 6	110	41	20					18	OCC	72.1	72 1	Rk
82	Leek, fresh (Egypt) (Allium porrum)	bulbs									4160	[p]	OCC	71	71	Rn
84	Leek, raw (CIS) (Allium porrum)										2100	[p]	unknown	84	84	-
90	Leek, boiled (Ethiopia) (Allium porrum)					40						7	Spectr.	90	90	O
91	Leek, cooked (Netherlands) (Allium porrum)					860						143	HPLC	91	91	Hc
3	Lemon grass (Thailand) (Cymbopogon citratus)	leaves	55	89.5		34						6	HPLC	73	73	Hc
9	Lemon grass (Taiwan) (Cymbopogon citratus)	(mature)									2208	[p]	OCC	71	71	Rk
83	Lengua de vaca (Mexico) (Rumex crispus)										4100	[p]	unknown	83	83	O
90	Lentil, flourq (Ethiopia) (Lens culinaris)					6630						1105	Spectr.	90	90	O
3	Lettuce (Thailand) (Lactuca sativa)		76	92.5		1039						173	HPLC	73	73	Hc
1	Lettuce, raw leaf type (Spain) (Lactuca sativa)	leaves (mature)	50	95.0	ND	172	ND	340	ND			29	HPLC	74.2	01	Hb

Carotenoid content of food (μg/100g edible portion, fresh weight)

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2	Lettuce (Guatemala) (Lactuca sativa)					1690						282	HPLC	78	78.2	Hn
1	Lettuce, raw iceberg type (Spain) (Lactuca sativa)	leaves (mature)	88	96.1	ND	48	ND	140	ND			8	HPLC	74.2	01	Hb
6	Lettuce (Malaysia) (Lactuca sativa)				0	97	0	73	0			16	HPLC	71.1	06	Hk
9	Lettuce Grand rapid (Taiwan) (Lactuca sativa)	(mature)									1410	[p]	OCC	71	71	Rk
9	Lettuce (Taiwan) (Lactuca sativa)	(mature)									1626	[p]	OCC	71	71	Rk
9	Lettuce prize head (Taiwan) (Lactuca sativa)	(mature)									1056	[p]	OCC	71	71	Rk
9	Lettuce (Taiwan) (Lactuca sativa)	leaves (mature)									2670	[p]	OCC	71	71	Rk
9	Lettuce Georgia (Taiwan) (Lactuca sativa)	(mature)									840	[p]	OCC	71	71	Rk
9	Lettuce celtuce (Taiwan) (Lactuca sativa)	(mature)									2280	[p]	OCC	71	71	Rk
9	Lettuce black seeded simpson (Taiwan) (Lactuca sativa)	(mature)									2250	[p]	OCC	71	71	Rk
26	Lettuce, raw (Egypt) (Lactuca sativa)				5	272						46	HPLC	74	74	Hk
34	Lettuce (Japan) (Lactuca scariola)	leaves				2906		4537			10195	[p]	HPLC	34	34	Hn

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47	Lettuce (Vietnam) (Lactuca sativa)										1440	[p]	HPLC/OCC	71	71	Hn
44	Lettuce (Hungary) (Lactuca sativa)	leaves				3120						520	HPLC	44	44	Hk
57	Lettuce, fresh (Australia) (Lactuca sativa)	leaves	87	95.8	20	60	40					15	OCC	72.1	72 1	Rk
70	Lettuce, raw (China) (Lactuca spp)		100	85.0							450	0	OCC	70	70	Rn
80	Lettuce (Nepal) (Lactuca sativa)					408						68	HPLC	80	80	Hn
79	Lettuce, raw (India) (Lactuca sativa)					1100						183	HPLC	79		Hn
90	Lettuce, raw (Ethiopia) (Lactuca sativa)					720						120	Spectr.	90	90	O
91	Lettuce, raw (Netherlands) (Lactuca sativa)					420						70	HPLC	91	91	Hc
57	Lettuce, cos, fresh (Australia) (Lactuca sativa)	leaves	72	94.1	10	590	40					103	OCC	72 1	72 1	Rk
70	Lettuce, garden, raw round-leaved (China) (Lactuca sativa capitata)		86	95.3							1420	0	OCC	70	70	Rn
84	Lettuce, leaf, raw (CIS) (Lactuca sativa)										1750	[p]	unknown	84	84	-
70	Lettuce, long-leaved, raw (China) (Lactuca sativa longifolia)		100	94.6							940 (400-1480)	0	OCC	70	70	Rn

Carotenoid content of food (µg/100g edible portion, fresh weight)

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57	Lettuce, mignonette, fresh (Australia) (Lactuca sativa)	leaves	53	94.7	30	520	90					98	OCC	72.1	72.1	Rk
47	Lily flower (Vietnam) (Hemerocallis fulval)										750	[p]	HPLC/OCC	71	71	Hn
9	Lima bean (Taiwan) (Phaseolus limensis)	pod (mature)									1350	[p]	OCC	71	71	Rk
9	Lima bean (Taiwan) (Phaseolus limensis)	leaves (mature)									10788	[p]	OCC	71	71	Rk
3	Lin-fa (Thailand) ()	flower	92	92.8		14						2	HPLC	73	73	Hc
8	Long bean (Malaysia) (Vigna sinensis)	(mature)			0	412		300				69	HPLC	71.3	06	Hk
6	Long bean, dark green (Malaysia) (Vigna sinensis)				0	569	0	423	0			95	HPLC	71.1	06	Hk
6	Long bean, light green (Malaysia) (Vigna sinensis)				0	412	0	300	0			69	HPLC	71.1	06	Hk
3	Lotus (Thailand) (Nymphoea pubescens Wild)	stem	83	97.0		14						2	HPLC	73	73	Hc
70	Lotus, raw (China) (Nelumbo nucifera)	rhizome	90								43	0	OCC	70	70	Pn
3	Lotus buds (Thailand) (Nymphoea pubescens Wild)		88	96.0		72						12	HPLC	73	73	Hc
3	Luk ka sung (Thailand) ()		21	71.4		0						0	HPLC	73	73	Hc

Carotenoid content of food (µg/100g edible portion, fresh weight)

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3	Luk nun (Thailand) ()	(young)	72	91 7		9						2	HPLC	73	73	Hc
3	Luk wai (Thailand) (Calamus ornatus)	(unripe)	86	64 1		52						9	HPLC	73	73	Hc
3	Luk yang pa, yellow (Thailand) ()		37	79.5		1024						171	HPLC	73	73	Hc
3	Luk yang, purple (Thailand) ()		51	83.6		0						0	HPLC	73	73	Hc
3	Luk yee (Thailand) ()		83	63.6		85						14	HPLC	73	73	Hc
9	Madeira vine (Taiwan) ()	(mature)									1560	[p]	OCC	71	71	Rk
34	Maize (Japan) (Zea mays)	leaves				6945		5139			13890	[p]	HPLC	34	34	Hn
47	Maize (Vietnam) (Zea mays)										540	[p]	HPLC/OCC	71	71	Hn
86	Maize, fried (Indonesia) (Zea mays)	leaves				36						6	HPLC	86	86	Hn
86	Maize, dried (Indonesia) (Zea mays)	leaves				191						32	HPLC	86	86	Hn
86	Maize, fresh (Indonesia) (Zea mays)				119	191						42	HPLC	86	86	Hn
86	Maize, steamed/grilled (Indonesia) (Zea mays)	leaves				12						2	HPLC	86	86	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

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3	Makok nam (Thailand) (Sapondias sp)		56	85 0		142						24	HPLC	73	73	Hc
2	Malabar gourd (Guatemala) (Cucurbita ficifolia)					2190						365	HPLC	78	78.2	Hn
9	Malabar spinach green (Taiwan) (Basella alba)	(mature)									2586	[p]	OCC	71	71	Rk
9	Malabar spinach (Taiwan) (Basella alba)	(mature)									3600	[p]	OCC	71	71	Rk
2	Malanga (Guatemala) (Xanthosoma violacium)					4420						737	HPLC	78	78 2	Hn
9	Malaunggay (Taiwan) (Moringa oleifera)	(mature)									6480	[p]	OCC	71	71	Rk
9	Malaunggay (Taiwan) (Moringa oleifera)	pod (mature)									0	[p]	OCC	71	71	Rk
9	Malaunggay (Taiwan) (Moringa oleifera)	leaves (mature)									5790	[p]	OCC	71	71	Rk
70	Mallow, raw (China) (Malva spp.)		77	91.4							6356 (1770-8980)	0	OCC	70	70	Rn
83	Malva (Mexico) (Malva parviflora)										6150	[p]	unknown	83	83	O
86	Mangkokan, fresh (Indonesia) ()	leaves			120	2240						384	HPLC	86	86	Hn
86	Mangkokan, dried (Indonesia) ()	leaves			960	11200						1950	HPLC	86	86	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref	Chr. ref	CM
86	Mangkokan, boiled (Indonesia) ()	leaves				631						105	HPLC	86	86	Hn
86	Mangkokan, steamed (Indonesia) ()	leaves				440						73	HPLC	86	86	Hn
3	Mango (Thailand) (Mangifera indica)	(ripe)	69	81.8		o73						112	HPLC	73	73	Hc
3	Mango Noi (Thailand) (Mangifera indica)	(ripe)	79	83.3		99						17	HPLC	73	73	Hc
3	Mango Nam-dok-mai (Thailand) (Mangifera indica)	(ripe)	70	80.3		770						128	HPLC	73	73	Hc
3	Mango Yai kram (Thailand) (Mangifera indica)	(ripe)	60	77.6		931						155	HPLC	73	73	Hc
3	Mango Leb-mue-nang (Thailand) (Mangifera indica)	(ripe)	69	82.7		110						18	HPLC	73	73	Hc
3	Mango Pung (Thailand) (Mangifera indica)	(ripe)	84	88.5		809						135	HPLC	73	73	Hc
3	Mango Ok-rong (Thailand) (Mangifera indica)	(ripe)	68	81.6		108						18	HPLC	73	73	Hc
3	Mango Sam-ru doo (Thailand) (Mangifera indica)	(ripe)	52	74.2		728						121	HPLC	73	73	Hc
3	Mango Pa (Thailand) (Mangifera indica)	(ripe)	44	81.3		42						7	HPLC	73	73	Hc
3	Mango Kai (Thailand) (Mangifera indica)	(ripe)	56	83.1		386						64	HPLC	73	73	Hc

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext ref.	Chr. ref.	Q
3	Mango Kaew sa-wei (Thailand) (Mangifera indica)	(unripe)	70	80 1		191						32	HPLC	73	73	Hc
3	Mango Kaew (Thailand) (Mangifera indica)	(ripe)	67	84.4		953						159	HPLC	73	73	Hc
3	Mango Ka-sem (Thailand) (Mangifera indica)	(ripe)	84	83.0		981						164	HPLC	73	73	Hc
3	Mango Him-ma-parn (Thailand) (Mangifera indica)	(ripe)	44	88.1		16						3	HPLC	73	73	Hc
3	Mango kaew (Thailand) (Mangifera indica)	leaves	35	76 5		186						31	HPLC	73	73	Hc
34	Maple (Japan) (Acer palmatum)	leaves				11497		12855			31584	[p]	HPLC	34	34	Hn
3	Mark-kai-kaw (Thailand) ()		40	84.8		916						153	HPLC	73	73	Hc
3	Mark-kang-kom (Thailand) ()		71	75.6		73						12	HPLC	73	73	Hc
3	Mark-pee-puan (Thailand) ()		45	91.3		3						1	HPLC	73	73	Hc
59	Marrow, fresh rough skin (Australia) (Cucurbita pepo ovifera)	pulp, seeds	79	94.6	20	20	60					11	OCC	72.1	72 1	Rk
59	Marrow, fresh smooth skin (Australia) (Cucurbita pepo ovifera)	pulp, seeds	77	93.0	10	30	0					6	OCC	72.1	72 1	Rk
84	Marrow, raw (CIS) ()										30	[p]	unknown	84	84	-

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext ref	Chr ref	QM
84	Marrow 'caviar' (CIS) ()										920	[p]	unknown	84	84	-
52	Mayalu, raw (India) (Basella rubra)					3004						501	HPLC	52	52	Hk
3	Ma-eok (Thailand) (Solanum majus)		92	82.5		978						163	HPLC	73	73	Hc
3	Ma-hard (Thailand) ()		89	79.4		814						136	HPLC	73	73	Hc
3	Ma-toom (Thailand) (Aegle marmelos)	leaves	44	76 0		953						159	HPLC	73	73	Hc
3	Ma-toom (Thailand) ()		53	65.3		0						0	HPLC	73	73	Hc
3	Ma-yom (Thailand) (Cicca acida)	leaves	66	76.1		9974						1662	HPLC	73	73	Hc
3	Ma-yom (Thailand) (Cicca acida)		86	90 8		5						1	HPLC	73	73	Hc
86	Melinjo, stewed/boiled (Indonesia) (Gnetum gnemon)	leaves			619	309						105	HPLC	86	86	Hn
86	Melinjo, boiled (Indonesia) (Gnetum gnemon)	leaves				169						28	HPLC	86	86	Hn
86	Melinjo, dried (Indonesia) (Gnetum gnemon)	leaves			168	7168						1209	HPLC	86	86	Hn
86	Melinjo, fresh (Indonesia) (Gnetum gnemon)	leaves			238	3526						608	HPLC	86	86	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr. ref.	QM
10	Mentruz, raw (Brazil) (Lepidium pseudodidymum)	leaves (mature)				8500				100	28500	1417	OCC	67	67.7	Rk
52	Methi, raw (India) (Trigonella foenum)					6421						1070	HPLC	52	52	Hk
2	Mint (Guatemala) (Mentha citrata,					9110		0				1518	HPLC	78	78.2	Hn
3	Mint (Thailand) (Mentha cordifolio)	leaves	63	87.9		3230						538	HPLC	73	73	Hc
9	Mint (Taiwan) (Mentha arvensis)	(mature)									4440	[p]	OCC	71	71	Rk
47	Mint (Vietnam) (Mentha aquatica)										4100	[p]	HPLC/OCC	71	71	Hn
47	Mint (Vietnam) (Mentha aquatica)										4220	[p]	HPLC/OCC	71	71	Hn
80	Mint (Nepal) (Mentha aquatica)					3677						613	HPLC	80	80	Hn
6	Mint leaves (Malaysia) (Mentha arvensis)				0	4836	0	1701	0			806	HPLC	71 1	06	Hk
79	Mint/pudina, raw (India) (Mentha arvensis)					5480						913	HPLC	79		Hn
43	Motor sak, raw leafy type (Bangladesh) (Pisum sativum)					8900 (7800-9920)						1483	OCC	43	43	Rk
43	Motor sak, cooked [e] leafy type (Bangladesh) (Pisum sativum)					7960						1327	OCC	43	43	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext ref.	Chr. ref.	QM
43	Mula sak, raw leafy type (Bangladesh) (Raphanus sativus)					6300 (5680-7640)						1050	OCC	43	43	Rk
43	Mula sak, cooked [e] leafy type (Bangladesh) (Raphanus sativus)					5100						850	OCC	43	43	Rk
79	Mulla thotakura, raw (India) (Amaranthus spinosus)					10800						1800	HPLC	79		Hn
79	Mullangantikura, raw (India) ()					1430						238	HPLC	79		Hn
70	Mung bean, raw (China) (Vigna spp)	sprouts	99								30	0	OCC	70	70	Rn
47	Mung bean, green (Vietnam) (Phaseolus aureus)										230	[p]	HPLC/OCC	71	71	Hn
9	Mungbean (Taiwan) (Vigna radiata)	(mature)									0	[p]	OCC	71	71	Rk
57	Mushroom, fresh Button type (Australia) (Agaricus bisporus)	whole	100	91.3	20	20	0					5	OCC	72.1	72 1	Rk
57	Mushroom, fresh Umbrella type (Australia) (Agaricus bisporus)	whole	100	92.6	10	20	0					4	OCC	72 1	72 1	Rk
87	Mushroom, raw (New Zealand) (Agaricus bisporus)		97	93.3	0	10						2	HPLC	87	87	Hn
9	Mustard (Taiwan) (Brassica juncea)	(mature)									1656	[p]	OCC	71	71	Rk
9	Mustard Shoi-ban (Taiwan) (Brassica juncea)	(mature)									780	[p]	OCC	71	71	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr. ref.	QM
40	Mustard cabbage, raw (Australia) (Brassica juncea)	leaf stem (mature)	94		140	1550	40					274	OCC	72.1	72.1	Rk
70	Mustard greens, raw (China) (Brassica juncea)		88	92 9							2460	0	OCC	70	70	Rn
80	Mustard leaves (Nepal) (Brassica compestris)					1604						267	HPLC	80	80	Hn
3	Mustard, green (Thailand) (Brassica juncea)	stem	88	94.0		76						13	HPLC	73	73	Hc
3	Mustard, green (Thailand) (Brassica jurcea)	leaves	68	93 9		1295						216	HPLC	73	73	Hc
9	Mustard, pickle (Taiwan) (Brassica juncea)	(mature)									1398	[p]	OCC	71	71	Rk
3	Nare (Thailand) ()		69	95.8		162						27	HPLC	73	73	Hc
3	Neem (Thailand) (Az-adirachta indica)	flower	53	70.1		524						87	HPLC	73	73	Hc
3	Neem (Thailand) (Az-adirachta indica)	leaves	53	70.2		4667						778	HPLC	73	73	Hc
2	Nightshade (Guatemala) (Solanum americanum)					19510		0				3252	HPLC	78	78.2	Hn
4	Nightshade, raw (Guatemala) (Solanum americanum)	leaves (mature)		86.9		3600						600	HPLC	71	75.1	Hk
4	Nightshade, cooked (Guatemala) (Solanum americanum)	leaves (mature)		87.5		ND						0	HPLC	71	75.1	Hk

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext ref.	Chr ref	QM
83	Nopal (Chlodides) (Mexico) (Opuntia spp)										250	[p]	unknown	83	83	O
43	Nunia sak, raw leafy type (Bangladesh) (Portulaca oleracea)					5400 (5050-5760)						900	OCC	43	43	Rk
3	Okra (Thailand) (Hibiscus esculentus)	fruit	88	91.9		116						19	HPLC	73	73	Hc
9	Okra lucky five (Taiwan) (Hibiscus esculentus)	(mature)									288	[p]	OCC	71	71	Rk
9	Okra South sea (Taiwan) (Hibiscus esculentus)	(mature)									270	[p]	OCC	71	71	Rk
59	Okra, fresh Clemson Spirless (Australia) (Hibiscus esculentus)	whole fruit	74	88.3	20	100	40					22	OCC	72 1	72.1	Rk
3	Olive ceylon (Thailand) (Canarrium album)		82	83.3		98						16	HPLC	73	73	Hc
84	Olive, green, preserved (CIS) (Olea europaea)										150	[p]	unknown	84	84	-
1	Onion, cooked (38 min) (Spain) (Allium cepa)	bulb (peeled) (mature)	89	93.2	ND	3	ND	5	ND	tr		1	HPLC	74.2	01	Hb
1	Onion, raw (Spain) (Allium cepa)	bulb (peeled) (mature)	89	90.9	ND	1	ND	2	ND	tr		0	HPLC	74 2	01	Hb
3	Onion (Thailand) (Allium cepa)	flower	100	94.2		431						72	HPLC	73	73	Hc
3	Onion (Thailand) (Allium cepa)		75	83.1		0						0	HPLC	73	73	Hc

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
79	Onion, raw (India) (Allium cepa)	leaves				4920						820	HPLC	79		Hn
82	Onion, fresh (Egypt) (Allium cepa)	green leaves									7000	[p]	CCC	71	71	Rn
87	Onion, raw (New Zealand) (Allium cepa)	flesh		87.9		0						0	HPLC	87	87	Hn
87	Onion, raw , Pukekohe Longkeeper (New Zealand) (Allium cepa)			87.7	0	0						0	HPLC	87	87	Hn
47	Onion fragant (Vietnam) (Allium odorum)										2850	[p]	HPLC/OCC	71	71	Hn
70	Onion, Chinese, raw (China) (Allium chinense)		88	87.9							1460	0	OCC	70	70	Rn
70	Onion, Welsh, raw short variety (China) (Allium fistulosum)		80	91.8							1870 (1600-2140)	0	OCC	70	70	Rn
70	Onion, Welsh, raw tall variety (China) (Allium fistulosum)		79	91.6							1243 (800-1330)	0	OCC	70	70	Rn
58	Onion, brown, fresh 'Cream Gold' (Australia) (Allium cepa)	bulb	82	90.8	20	0	0					2	OCC	72.1	72.1	Rk
70	Onion, common, raw (China) (Allium cepa)	bulb	86	88.7							0 (tr-20)	0	OCC	70	70	Rn
3	Onion, green (Thailand) (Allium ascalonicum)	stem (young)	83	91.2		447						75	HPLC	73	73	Hc
58	Onion, spring, fresh spring (Australia) (Allium cepa)	stem, bulb	78	90.5	10	610	20					104	OCC	72.1	72.1	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	ΣP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	PE	Princ. method	Ext. ref.	Chr. ref.	QM
58	Onion, white, fresh 'White Spanish' (Australia) (Allium cepa)	bulb	80	90.1	0	10	0					2	OCC	72 1	72.1	Rk
84	Onion, yellow, raw (CIS) ()										0	[p]	unknown	84	84	-
3	Orange (Thailand) (Citrus sinensis)		75	84.1		71						12	HPLC	73	73	Hc
9	Pai Tsai Fong-shan (Taiwan) (Brassica campestris)	(mature)									1146	[p]	OCC	71	71	Pk
9	Pai-Tsai Ji-Tan-Gun (Taiwan) (Brassica campestris)	(mature)									2430	[p]	OCC	71	71	Rk
9	Pai-Tsai (Taiwan) (Brassica campestris)	(mature)									1080	[p]	OCC	71	71	Rk
9	Pai-Tsai golden (Taiwan) (Brassica campestris)	(mature)									1188	[p]	OCC	71	71	Rk
9	Pai-Tsai Native (Taiwan) (Brassica campestris)	(mature)									696	[p]	OCC	71	71	Rk
3	Pak Kra-done (Thailand) (Careya arborea)	flower	57	81.0		403						67	HPLC	73	73	Hc
3	Pak Kra-done (Thailand) (Careya arborea)		54	73.5		971						162	HPLC	73	73	Hc
3	Pak chee laos (Thailand) (Anethum graveolens)		49	88.1		1713						286	HPLC	73	73	Hc
3	Pak e-hin (Thailand) ()		78	93.7		1653						276	HPLC	73	73	Hc

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref	Chr. ref.	QM
3	Pak e-lum (Thailand) ()		37	80 5		1454						242	HPLC	73	73	Hc
3	Pak hob-heb (Thailand) ()		65	95 1		1027						171	HPLC	73	73	Hc
3	Pak hua-ling (Thailand) ()		81	76.6		499						83	HPLC	73	73	Hc
3	Pak kad (Thailand) ()		41	87.8		3708						618	HPLC	73	73	Hc
3	Pak kang-kom (Thailand) ()		85	93.6		48						8	HPLC	73	73	Hc
3	Pak kang-som (Thailand) ()		42	87.4		747						125	HPLC	73	73	Hc
3	Pak kan-tong (Thailand) ()		41	86.6		4175						696	HPLC	73	73	Hc
3	Pak ka-ya (Thailand) ()		45	79.0		930						155	HPLC	73	73	Hc
3	Pak ka-yang (Thailand) (Limnophila aromatica)		52	91 3		218						36	HPLC	73	73	Hc
3	Pak kol-kan (Thailand) ()		50	84.7		503						84	HPLC	73	73	Hc
3	Pak lin-fa (Thailand) ()		90	84.2		224						37	HPLC	73	73	Hc
3	Pak lin-mai (Thailand) ()		31	81 0		5121						854	HPLC	73	73	hc

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
3	Pak lin-pee (Thailand) ()		47	90.8		3908						651	HPLC	73	73	Hc
3	Pak meg (Thailand) (Syzygium gratum wall)		48	81.1		536						89	HPLC	73	73	Hc
3	Pak mued (Thailand) ()		60	80.0		1384						231	HPLC	73	73	Hc
3	Pak narm (Thailand) (Lasia spinosa)		70	94.2		268						45	HPLC	73	73	Hc
3	Pak nor (Thailand) ()		55	95.1		1192						199	HPLC	73	73	Hc
3	Pak om-am (Thailand) ()		57	86.6		2644						441	HPLC	73	73	Hc
3	Pak pae (Thailand) ()		72	92.8		414						69	HPLC	73	73	Hc
3	Pak paew (Thailand) ()		43	81.4		3981						664	HPLC	73	73	Hc
3	Pak pai (Thailand) ()		89	94.9		4						1	HPLC	73	73	Hc
3	Pak pong (Thailand) ()		84	95.0		1063						177	HPLC	73	73	Hc
3	Pak sai (Thailand) ()		27	86.9		5076						846	HPLC	73	73	Hc
3	Pak sarb (Thailand) ()		53	82.5		1925						321	HPLC	73	73	Hc

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext ref.	Chr ref.	QM
3	Pak sean (Thailand) (Crataeva roxburghii)		55	91.8		6269						1045	HPLC	73	73	Hc
3	Pak sean, pickled (Thailand) (Crataeva roxburghii)		60	90.0		2214						369	HPLC	73	73	Hc
3	Pak tiew (Thailand) (Cratorylon sp.)		57	80.8		2034						339	HPLC	73	73	Hc
3	Pak tob-noi (Thailand) ()		33	92.6		1773						296	HPLC	73	73	Hc
3	Pak wan (Tha land) (Marsilea crenata)		60	92.0		592						99	HPLC	73	73	Hc
3	Pak whan (ban) (Thailand) (Sauropus albican)		43	82.5		3097						516	HPLC	73	73	Hc
43	Palang sak, cooked [e] leafy type (Bangladesh) (Spinacea oleracea)					4750						792	OCC	43	43	Rk
43	Palang sak, raw leafy type (Bangladesh) (Spinacea oleracea)					6400 (5040-7690)						1067	OCC	43	43	Rk
3	Pang-pui (Thailand) ()		48	87.9		366						61	HPLC	73	73	Hc
79	Panpandlakura, raw (India) ()					1280						213	HPLC	79		Hn
3	Papaya (Thailand) (Carica papaya)	(ripe)	71	87.4		1043						174	HPLC	73	73	Hc
86	Papaya, boiled (Indonesia) (Carica papaya)	leaves				1143						191	HPLC	86	86	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	Q4
86	Papaya, dried (Indonesia) (Carica papaya)	leaves			1493	15573						2725	HPLC	86	86	Hn
86	Papaya, fresh (Indonesia) (Carica papaya)	leaves			336	7392						1261	HPLC	86	86	Hn
86	Papaya, boiled (Indonesia) (Carica papaya)	leaves			24	1143						193	HPLC	86	86	Hn
6	Papaya shoots (Malaysia) (Carica papaya)				0	1829	0	821	0			305	HPLC	71.1	06	Hk
6	Paprika, Bell pepper (Malaysia) (Capsicum annuum)				0	267	0	223	0			45	HPLC	71 1	06	Hk
50	Paprika, black (Hungary, Szente) (Capsicum annuum)	fruit (stage 3)									378900	0	HPLC	50	50	Hk
50	Paprika, black (Hungary, Szente) (Capsicum annuum)	fruit (stage 1)									48500	0	HPLC	50	50	Hk
50	Paprika, black (Hungary, Szente) (Capsicum annuum)	fruit (stage 2)									162000	0	HPLC	50	50	Hk
50	Paprika, black (Hungary, Szente) (Capsicum annuum)	fruit (stage 5)									1960600	0	HPLC	50	50	Hk
50	Paprika, black (Hungary, Szente) (Capsicum annuum)	fruit (stage 4)									1753900	0	HPLC	50	50	Hk
50	Paprika, black (Hungary, Szente) (Capsicum annuum)	fruit (stage 6)									3211000	0	HPLC	50	50	Hk
2	Parsley (Guatemala) (Petroselinum crispum)					5290						882	HPLC	78	78.2	Hn

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr. ref.	QM
18	Parsley, dried (Dominican Repub) (Petroselinum crispum)			41 9	132	2110						363	HPLC	74	-	Hn
57	Parsley, fresh (Australia) (Petroselinum crispum)	leaf	45	89 0	4850	4850	80					1238	OCC	72 1	72 1	Rk
57	Parsley, fresh Continental (Australia) (P crispum neapolitanum)	leaf	64	89.2	40	3810	250					661	OCC	72.1	72 1	Rk
84	Parsley, raw (CIS) (Petroselinum crispum)										5700	[p]	unknown	84	84	-
58	Parsnip, fresh (Australia) (Pastinaca sativa)	root	83	83 4	20	20	0					5	OCC	72 1	72 1	Rk
84	Parsnip (CIS) (Pastinaca sativa)	root									20	[p]	unknown	84	84	-
43	Pat sak, raw leafy type (Bangladesh) (Chorchorus capsularis)					10000 (8290-11800)						1667	OCC	43	43	Rk
9	Peanut (Taiwan) (Arachis hypogaea)	(mature)									0	[p]	OCC	71	71	Rk
31	Peas, cooked (Pakistan) (Pisum sativum)					160						27	OCC	71 4	71 1	Rz
31	Peas, raw (Pakistan) (Pisum sativum)					260						43	OCC	71.4	71 1	Rz
26	Peas, raw (Egypt) (Pisum sativum)				22	415						71	HPLC	74	74	Hk
59	Peas, fresh (Australia) (Pisum sativum saccharatum)	seed, pod	96	87.6	10	190	10					33	OCC	72.1	72 1	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
91	Peas, frozen, cooked (Netherlands) (Pisum sativum)					330						55	HPLC	91	91	Hc
91	Peas, canned (Netherlands) (Pisum sativum)					340						57	HPLC	91	91	Hc
96	Peas, boiled (Australia) (Pisum sativum)				0	380	70					70	HPLC	96	96	Hn
70	Peas, common, raw (China) (Pisum sativum sativum)		40								213	0	OCC	70	70	Rn
70	Peas, common, raw large (China) (Pisum sativum sativum)		47								330	0	OCC	70	70	Rn
70	Peas, common, raw (China) (Pisum sativum sativum)	sprouts	47								1590	0	OCC	70	70	Rn
21	Peas, green, fresh (USA) (Pisum sativum)	(ripe)									1480 [c]	0	OCC	21	21	Rn
44	Peas, green Jof (Hungary) (Pisum sativum)					220						37	HPLC	44	44	Hk
85	Peas, green, boiled/canned (Croatia) (Pisum sativum)										290	[p]	OCC	85	85	Rn
84	Peas, green, drained (CIS) (Pisum sativum)										500	[p]	unknown	84	84	-
84	Peas, green, preserved (CIS) (Pisum sativum)										300	[p]	unknown	84	84	-
84	Peas, green, raw (CIS) (Pisum sativum)										400	[p]	unknown	84	84	-

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext ref	Chr. ref.	QM
85	Peas, green, fresh (Croatia) (Pisum sativum)										360	[p]	OCC	85	85	Rn
87	Peas, green, frozen, uncooked (New Zealand) (Pisum sativum)		100	77.5	0	311						52	HPLC	87	87	Hn
87	Peas, green, raw (New Zealand) (Pisum sativum)		41	77.1	0	311						52	HPLC	87	87	Hn
87	Peas, green, frozen, boiled (New Zealand) (Pisum sativum)					280						47	HPLC	87	87	Hn
87	Peas, green, boiled (New Zealand) (Pisum sativum)					280						47	HPLC	87	87	Hn
87	Peas, green, canned (New Zealand) (Pisum sativum)					280						47	HPLC	87	87	Hn
96	Peas, green, raw (Australia) (Pisum sativum)				0	400	50					100	HPLC	96	96	Hn
6	Pegaga gajah (Malaysia) (Hydrocotyle javanica)				0	3840	0	1305	0			640	HPLC	71 1	06	Hk
63	Pepper, Mexican, fresh Verde (Mexico, Hermosi) (Capsicum annuum)	flesh (immature)		92.4	20	170	2					30	HPLC	74 3	75	Hk
63	Pepper, Mexican, fresh Serrano (Mexico, Hermosi) (Capsicum annuum)	flesh (immature)		88.4	17	510	4					87	HPLC	74.3	75	Hk
63	Pepper, Mexican, fresh Jalapeño (Mexico, Hermosi) (Capsicum annuum)	flesh (immature)		91.5	53	376	ND					67	HPLC	74 3	75	Hk
63	Pepper, Mexican, fresh Poblano (Mexico, Hermosi) (Capsicum annuum)	flesh (immature)		90.4	110	599	7					110	HPLC	74.3	75	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr. ref.	QM
63	Pepper, Mexican, fresh Caribe (Mexico, Hermosi) (Capsicum annuum)	flesh (immature)		91 6	ND	13	ND					2	HPLC	74 3	75	Hk
3	Pepper, fresh (Thailand) (Piper nigrum)		90	83 2		172						29	HPLC	73	73	Hc
1	Pepper, green, cooked (25 min) (Spain) (Capsicum annuum)	fruit no seeds (mature)	95	94.1	ND	255	ND	377	ND			43	HPLC	74.2	01	Hb
1	Pepper, green, raw (Spain) (Capsicum annuum)	fruit, no seeds (mature)	95	92 6	ND	205	ND	341	ND			34	HPLC	74.2	01	Hb
26	Pepper, green, raw (Egypt) (Capsicum annuum)				101	472						87	HPLC	74	74	Hk
44	Pepper, green Szegedi-20 (Hungary) (Capsicum annuum)					1440						240	HPLC	44	44	Hk
44	Pepper, green Bell-boy (Hungary) (Capsicum annuum)					880						147	HPLC	44	44	Hk
44	Pepper, green Angeli emlike (Hungary) (Capsicum annuum)					1560						260	HPLC	44	44	Hk
70	Pepper, green, raw (China) (Capsicum frutescens)	shoot tips	90	34.3							280	0	OCC	70	70	Rn
84	Pepper, green, raw (CIS) (Caps cum annuum)										1000	[p]	unknown	84	84	-
9	Pepper, hot (Taiwan) (Capsicum frutescens)	(mature)									1200	[p]	OCC	71	71	Rk
82	Pepper, hot, fresh (Egypt) (Capsicum pubescens)										5500	[p]	OCC	71	71	Rn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext ref	Chr. ref.	QM
1	Pepper, red, cooked (38 min) (Spain) (Capsicum annuum)	fruit, no seeds (mature)	85	90 3	ND	693	243	0	ND	197		138	HPLC	74.2	01	Hb
1	Pepper, red, raw (Spain) (Capsicum annuum)	fruit, no seeds (mature)	85	91 4	ND	414	199	0	ND	148		87	HPLC	74 2	01	Hb
29	Pepper, red, raw Americano (Spain) (Capsicum annuum)	fruit (mature)		57 5		43000	14000	3000		34000		8455	HPLC	29	29	Hn
29	Pepper, red, raw AmlerB51EB1 (Spain) (Capsicum annuum)	fruit (mature)		85.9		156000	51000	9000		53000		30692	HPLC	29	29	Hn
29	Pepper, red, raw NAN (Spain) (Capsicum annuum)	fruit (mature)		39.3		105000	30000	35000		26000		20260	HPLC	29	29	Hn
29	Pepper, red, raw Albar x M CA (Spain) (Capsicum annuum)	fruit (mature)		22.1		35000	16000	7000		27000		7305	HPLC	29	29	Hn
29	Pepper, red, raw AmlerB51 (Spain) (Capsicum annuum)	fruit (mature)		85.7		113000	41000	13000		58000		22605	HPLC	29	29	Hn
29	Pepper, red, raw Belrubi (Spain) (Capsicum annuum)	fruit (mature)		82.5		122000	35000			60000		23553	HPLC	29	29	Hn
29	Pepper, red, raw Negral (Spain) (Capsicum annuum)	fruit (mature)		58.1		109000	42000	17000		43000		22031	HPLC	29	29	Hn
84	Pepper, red, raw (CIS) (Capsicum annuum)										2000	[p]	unknown	84	84	-
90	Pepper, red, boiled (Ethiopia) (Capsicum annuum)					3280						547	Spectr	90	90	O
36	Pepper, red Bell, raw (USA) (Capsicum annuum)	fruit (ripe)				120						20	HPLC	36	36	Hk

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref	Chr. ref	QM
36	Pepper, red Bell, raw (USA) (Capsicum annuum)	fruit (ripe)				1940	1460 [b]					458	HPLC	36	36	Hk
53	Pepper, red Bell, raw (USA) (Capsicum annuum)	fruit				2978						496	HPLC	53	53	Hc
95	Pepper, red, hot, dried Kalocsa type (Hungary) (Capsicum annuum)										80000		Fluor	95	95	O
95	Pepper, red, hot, dried Szeged type (Hungary) (Capsicum annuum)										46000		Fluor.	95	95	O
95	Pepper, red, sweet, dried Szeged type (Hungary) (Capsicum annuum)										54000		Fluor.	95	95	O
95	Pepper, red, sweet, dried Kalocsa type (Hungary) (Capsicum annuum)										46000		Fluor	95	95	O
82	Pepper, sweet, fresh (Egypt) (Capsicum annuum)										1500	[p]	OCC	71	71	Rn
90	Pepper, sweet, green, boiled (Ethiopia) (Capsicum annuum)					240						40	Spectr.	90	90	O
77	Pepper, yellow, raw (U K) (Capsicum annum grossum)	no seeds/stalk	83	90.6	55	135	40					31	HPLC	77	67	Hk
34	Perilla (Japan) (Perilla frutescens)	leaves				9245		5806			22330	[p]	HPLC	34	34	Hn
70	Perilla, purple, raw (China) (Perilla spp)		76	85.7							9090	0	OCC	70	70	Rn
86	Petai, dried (Indonesia) (Parkia speciosa)	leaves				71						12	HPLC	86	86	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref	Chr. ref	QM
86	Petai, heated over flame (Indonesia) (Parkia speciosa)					24						4	HPLC	86	86	Hn
86	Petai, stewed (Indonesia) (Parkia speciosa)					71						12	HPLC	86	86	Hn
86	Petai, fresh (Indonesia) (Parkia speciosa)					71						12	HPLC	86	86	Hn
3	Pigeonpea (Thailand) (Cajanus cajan)	immature seed	38	60.0		50						8	HPLC	73	73	Hc
3	Pigeonpea, cooked (Thailand) (Cajanus cajan)		35	63.3		38						6	HPLC	73	73	Hc
80	Pigwid (Nepal) (Amaranthus viridis)					7532						1255	HPLC	80	80	Hn
80	Pigwig (Nepal) (Amaranthus viridis)					9226						1538	HPLC	80	80	Hn
3	Pineapple (Thailand) (Ananas comosus)		45	85.0		10						2	HPLC	73	73	Hc
3	Pomelo (Thailand) (Citrus grandis)		47	91.2		0						0	HPLC	73	73	Hc
79	Ponnagantikura, raw (India) (Alternanthera sessilis)					5440						907	HPLC	79		Hn
1	Potato, cooked (20 min) early crop (Spain) (Solanum tuberosum)	tuber (peeled) (mature)	74	81.9	0	2	0	44	ND	21		0	HPLC	74.2	01	Hb
1	Potato, raw early crop (Spain) (Solanum tuberosum)	tuber (peeled) (mature)	74	80.3	0	1	0	12	ND	4		0	HPLC	74.2	01	Hb

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
9	Potato Kadera (Taiwan) (Solanum tuberosum)	(mature)									216	[p]	OCC	71	71	Rk
70	Potato, raw (China) (Solanum tuberosum)		92								17	0	OCC	70	70	Rn
87	Potato, raw , Red King (New Zealand) (Solanum tuberosum)		99	81.0		6						1	HPLC	87	87	Hn
87	Potato, microwaved (New Zealand) (Solanum tuberosum)			72.4		13						2	HPLC	87	87	Hn
87	Potato, fried (New Zealand) (Solanum tuberosum)		100	56.4		34						6	HPLC	87	87	Hn
87	Potato, fried (New Zealand) (Solanum tuberosum)		100	58.2		23						4	HPLC	87	87	Hn
87	Potato, boiled , Rua (New Zealand) (Solanum tuberosum)		100	77.1		7						1	HPLC	87	87	Hn
87	Potato, raw , Red King (New Zealand) (Solanum tuberosum)	flesh	88	79.6		6						1	HPLC	87	87	Hn
87	Potato, raw , Rua (New Zealand) (Solanum tuberosum)	flesh	84	79.9		6						1	HPLC	87	87	Hn
87	Potato, mashed (New Zealand) (Solanum tuberosum)		100	79 3		39						7	HPLC	87	87	Hn
87	Potato, raw (New Zealand) (Solanum tuberosum)	flesh and skin	96	78.5		6						1	HPLC	87	87	Hn
87	Potato, roasted (New Zealand) (Solanum tuberosum)		100	71.8		10						2	HPLC	87	87	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref	Chr ref	QM
87	Potato, fried (New Zealand) (Solanum tuberosum)			63.3		71						12	HPLC	87	87	Hn
87	Potato, raw , Ilam Hardy (New Zealand) (Solanum tuberosum)	flesh	85	79.1	0	0						0	HPLC	87	87	Hn
47	Potato leaf (Vietnam) (Ipomoea batatas)										3290	[p]	HPLC/OCC	71	71	Hn
87	Potato, Rua, boiled , Rua (New Zealand) (Solanum tuberosum)	flesh	100	77.1		7						1	HPLC	87	87	Hn
87	Potato, Rua, baked , Rua (New Zealand) (Solanum tuberosum)		100	75.4		7						1	HPLC	87	87	Hn
58	Potato, new, fresh 'Pontiac, Sebago' (Australia) (Solanum tuberosum)	tuber	85	81.2	0	0	0					0	OCC	72 1	72 1	Rk
87	Potato, new, canned (New Zealand) (Solanum tuberosum)					7						1	HPLC	87	87	Hn
84	Potato white, raw (CIS) (Solanum tuberosum)										20	[p]	unknown	84	84	-
80	Prostrate (Nepal) ()					3577						596	HPLC	80	80	Hn
87	Puha, raw (New Zealand) (Sonchus oleraceus)		37	91.4	0	7790						1298	HPLC	87	87	Hn
43	Pui sak, cooked [e] leafy type (Bangladesh) (Basella alba)					3600						600	OCC	43	43	Rk
43	Pui sak, raw leafy type (Bangladesh) (Basella alba)					5600 (4160-6740)						933	OCC	43	43	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-cryptc (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext ref	Chr. ref.	QM
3	Pum (Thailand) ()		97	96.3		384						64	HPLC	73	73	Hc
3	Pumpkin (Thailand) (Cucurbita maxima)	leaves	56	89.3		2245						374	HPLC	73	73	Hc
3	Pumpkin (Thailand) (Cucurbita maxima)		77	81.7		376						63	HPLC	73	73	Hc
6	Pumpkin (Malaysia) (Cucurbita maxima)				756	578	0	940	0			162	HPLC	71.1	06	Hk
22	Pumpkin, raw Exposiçao (Brazil) (Cucurbita maxima)	fruit (mature)			10 (ND-20)	1660 (310-2800)	30 (ND-80)	1020 (720-2530)		240 (ND-970)		280	OCC	67	67	Rk
22	Pumpkin, raw Tetsukabuto (Brazil) (Cucurbita maxima)	fruit (mature)			20 (ND-50)	1290 (870-1780)	930 (80-1800)	1930 (350-3390)		130 (tr-650)		302	OCC	67	67	Rk
18	Pumpkin, dried (Haiti) (Curcubita maxima)			12.6	1800	6170						1185	HPLC	74	-	Hn
22	Pumpkin, raw Tetsukabuto (Brazil) (Cucurbita maxima)	pulp (mature)			50	1650	160	1880		650		294	OCC	67	67	Rk
22	Pumpkin, raw Tetsukabuto (Brazil) (Cucurbita maxima)	peel (mature)			1800	10060	1850	29600		12940		2008	OCC	67	67	Rk
9	Pumpkin (Taiwan) (Cucurbita moschata)	(mature)									2340	[p]	OCC	71	71	Rk
19	Pumpkin, raw Jerimum Caboclo (Brazil) (Cucurbita maxima)	fruit (mature)			40 (20-60)	2100 (1420-3430)		4710 (640-12870)		tr (ND-20)		353	OCC	67	67	Rk
47	Pumpkin (Vietnam) (Cucurbita pepo)										1590	[p]	HPLC/OCC	71	71	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Chr. ref.	QM
59	Pumpkin, fresh Queensland Blue (Australia) (Cucurbita maxima)	pulp	85	83 8	40	1680	2140					480	OCC	72.1	72.1	Rk
59	Pumpkin, fresh Golden Nugget (Australia) (Cucurbita maxima)	pulp	70	91.3	800	2710	530					570	OCC	72.1	72.1	Rk
59	Pumpkin, fresh Butternut (Australia) (Cucurbita moschata)	pulp	86	85.8	300	1160	2930					489	OCC	72.1	72.1	Rk
80	Pumpkin, ripe (Nepal) (Cucurbita maxima)					2177						363	HPLC	80	80	Hn
79	Pumpkin, raw (India) (Cucurbita minima)					1160						193	HPLC	79		Hn
85	Pumpkin (Croatia) (Cucurbita maxima)										3120	[p]	OCC	85	85	Rn
87	Pumpkin, roasted (New Zealand) (Cucurbita spp.)			84.5		3169						528	HPLC	87	87	Hn
87	Pumpkin, raw (New Zealand) (Cucurbita maxima)	flesh	72	89.5	0	3533						589	HPLC	87	87	Hn
87	Pumpkin, raw , Kumi Kumi (New Zealand) (Cucurbita maxima)	flesh	62	92.5	0	494						82	HPLC	87	87	Hn
87	Pumpkin, raw , Triamble (New Zealand) (Cucurbita maxima)	flesh	73	87.0	0	6175						1029	HPLC	87	87	Hn
90	Pumpkin, fried (Ethiopia) (Cucurbita pepo)					2490						415	Spectr.	90	90	O
87	Pumpkin, raw , Whangaparaoa Crown (New Zealand) (Cucurbita maxima)		73	88.7	0	5315						886	HPLC	87	87	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref	Chr. ref	QM
94	Pumpkin, raw (Australia) (Cucurbita spp)				20	540			< 30			90	HPLC	94	94	Hc
80	Pumpkin leaves (Nepal) (Cucurbita pepo)	leaves				497						83	HPLC	80	80	Hn
80	Pumpkin, green (Nepal) (Cucurbita maxima)					165						28	HPLC	80	80	Hn
89	Pumpkin, orange, fresh (Japan) (C maxima Kurikabocha)	flesh			10	528	39	1471		211	3240	92	OCC	89	89	Rk
52	Pumpkin, red, raw (India) (Cucurbita maxima)					121						20	HPLC	52	52	Hk
89	Pumpkin, yellow, fresh (Japan) (C moschata Krokawa)	flesh			12	505	122	922			2340	96	OCC	89	89	Rk
47	Pumpkin/squash (Vietnam) (Cucurbita pepo)										1650	[p]	HPLC/OCC	7.	71	Hn
2	Purslane (Guatemala) (Portulaca oleracea)					4790						798	HPLC	78	78.2	Hn
83	Quelite (Mexico) (Amaranthus chlorostachys)										3650	[p]	unknown	83	83	O
2	Radish (Guatemala) (Raphanus sativus)					4500						750	HPLC	78	78 2	Hn
9	Radish (Taiwan) (Raphanus sativus)	(mature)									60	[p]	OCC	71	71	Rk
9	Radish Ming-ho (Taiwan) (Raphanus sativus)	(mature)									12	[p]	OCC	71	71	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext ref	Chr ref	QM
9	Radish red skin (Taiwan) (Raphanus sativus)	(mature)									186	[p]	OCC	71	71	Rk
9	Radish red skin (Taiwan) (Raphanus sativus)	leaves (mature)									1878	[p]	OCC	71	71	Rk
9	Radish (Taiwan) (Raphanus sativus)	leaves (mature)									1128	[p]	OCC	71	71	Rk
34	Radish (Japan) (Raphanus sativus)	leaves				3005		5047			10580	[p]	HPLC	34	34	Hn
58	Radish, fresh white skin (Australia) (Raphanus sativus)	root	70	92.9	20	30	0					7	OCC	72.1	72.1	Rk
52	Radish, raw (India) (Raphanus sativus)	leaves				3668						611	HPLC	52	52	Hk
58	Radish, fresh red skin (Australia) (Raphanus sativus)	root	49	94.9	10	10	0					3	OCC	72.1	72.1	Rk
79	Radish, raw (India) (Raphanus sativus)	leaves				2200						367	HPLC	79		Hn
84	Radish, raw (CIS) (Raphanus sativus)										20	[p]	unknown	84	84	-
70	Radish greens, raw (China) (Raphanus sativa)		94	92.2							1925 (1750-2100)	0	OCC	70	70	Rn
80	Radish leaves (Nepal) (Raphanus sativus)	leaves				301						50	HPLC	80	80	Hn
70	Radish, greens, oriental, raw winter variety (China) (Raphanus sativa)		71	94.5							2577 (2020-3390)	0	OCC	70	70	Rn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
70	Radish, greens, purple, raw (China) (Raphanus sativa)			93.4							760	0	OCC	70	70	Rn
70	Radish, greens, red, raw small variety (China) (Raphanus sativa)		100	93.5							2890	0	OCC	70	70	Rn
70	Radish, pale green, raw (China) (Raphanus sativus)		96								260	0	OCC	70	70	Rn
70	Radish, purple, raw (China) (Raphanus sativus)		71								30	0	OCC	70	70	Rn
70	Radish, red, large, raw (China) (Raphanus sativus)		83								10	0	OCC	70	70	Rn
70	Radish, red, small, raw (China) (Raphanus sativus)		63								10	0	OCC	70	70	Rn
70	Radish, white, raw (China) (Raphanus sativus)		92								23	0	OCC	70	70	Rn
83	Ramón (Mexico) (Brosimum alicastrum)										6520	[p]	unknown	83	83	O
86	Randamidang, dried (Indonesia) ()	leaves				5362						894	HPLC	86	86	Hn
86	Randamidang, fresh (Indonesia) ()				143	3098						529	HPLC	86	86	Hn
86	Randamidang, boiled (Indonesia) ()	leaves				977						163	HPLC	86	86	Hn
86	Randamidang, steamed (Indonesia) ()	leaves				643						107	HPLC	86	86	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
6	Ranti (Malaysia) (Solanum nigrum)				0	7048	0	2888	0			1175	HPLC	71.1	06	Hk
47	Rape (Vietnam) (Brassica campestris)					580					2590	[p]	HPLC/OCC	71	71	Hn
80	Rape leaves (Nepal) (Brassica juncea)					1785						298	HPLC	80	80	Hn
70	Rape oil, raw summer harvest (China) (B. chinensis oleifera)		79	91.0							3730	0	OCC	70	70	Rn
80	Rape shoots, tender (Nepal) (Brassica juncea)					872						145	HPLC	80	80	Hn
9	Rape, green Yu-tsai-sin (Taiwan) (Brassica campestris)	(mature)									4746	[p]	OCC	71	71	Rk
9	Rape, green (Taiwan) (Brassica campestris)	(mature)									2436	[p]	OCC	71	71	Rk
91	Red cabbage (Netherlands) (B oleracea capitata)					0						0	HPLC	91	91	Hc
57	Rhubarb, fresh (Australia) (Rheum rhabarbicum)	stem	61	92.0	10	90	10					17	OCC	72.1	72.1	Rk
84	Rhubarb (CIS) (Rheum rhabarbicum)										60	[p]	unknown	84	84	-
5	Riceroot, raw (British Columbi) (Fritillaria camschat.)	bulbs (mature)		74		2						0	HPLC	76 1	76	Hk
2	Roctish (Guatemala) (Cnidoscolus chayamansa)					4730						788	HPLC	78	78.2	Hn

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref.	Clr. ref.	QM
4	Roctish, raw (Guatemala) (Cnidoscolus chayamansa)	leaves (mature)		91 7		4900						817	HPLC	71	75 1	Hk
4	Roctish, cooked (Guatemala) (Cnidoscolus chayamansa)	leaves (mature)		92.4		9100						1517	HPLC	71	75.1	Hk
83	Romeritos (Mexico) (Dondia sufrulencona)										2760	[p]	unknown	83	83	O
9	Root beet ruby queen (Taiwan) (Beta vulgaris)	leaves (mature)									2250	[p]	OCC	71	71	Rk
9	Root beet ruby queen (Taiwan) (Beta vulgaris)	root (mature)									150	[p]	OCC	71	71	Rk
3	Roselle (Thailand) (Hibiscus sabdariffa)	leaves	60	83.3		796						133	HPLC	73	73	Hc
91	Runner bean, cooked (Netherlands) (Phaseolus vulgaris)					200						33	HPLC	91	91	Hc
70	Rutabaga, raw (China) (B napus napobrassica)		100	92.9							10	0	OCC	70	70	Rn
84	Rutabaga, raw (CIS) (B napus napobrassica)										50	[p]	unknown	84	84	-
70	Rutabaga greens, raw (China) (B. napus napobrassica)			92.0							1900	0	OCC	70	70	Rn
3	Sai-pla-lai (Thailand) ()		44	82.1		7226						1204	HPLC	73	73	Hc
6	Salted vegetables (Malaysia) ()				0	3395	0	7318	0			566	HPLC	71 1	06	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext. ref	Chr. ref	QM
2	Samat (Guatemala) (Eringium foetidum)					5230						872	HPLC	78	78.2	Hn
4	Samat, cooked (Guatemala) (Eryngium foetidum)	leaves (mature)		74 0		22400						3733	HPLC	71	75 1	Hk
4	Samat, raw (Guatemala) (Eryngium foetidum)	leaves (mature)		89.9		2100						350	HPLC	71	75 1	Hk
91	Sauerkraut, raw (Netherlands) (B oleracea capitata)					0						0	HPLC	91	91	Hc
47	Sauropus (Vietnam) (Sauropus androgynus)				300	3340					10050	[p]	HPLC/OCC	71	71	Hn
86	Sauropus, boiled (Indonesia) (Sauropus androgynus)	leaves				572						95	HPLC	86	86	Hn
86	Sauropus, boiled (Indonesia) (Sauropus androgynus)	leaves				137						23	HPLC	86	86	Hn
86	Sauropus, fresh (Indonesia) (Sauropus androgynus)	leaves			115	7728						1298	HPLC	86	86	Hn
86	Sauropus, dried (Indonesia) (Sauropus androgynus)	leaves			1400	24360						4182	HPLC	86	86	Hn
9	Scallion (Taiwan) (Allium bakeri)	stem (mature)									276	[p]	OCC	71	71	Rk
9	Scallion (Taiwan) (Allium bakeri)	leaves (mature)									1758	[p]	OCC	71	71	Rk
84	Scallion, raw (CIS) (Allium bakeri)										2000	[p]	unknown	84	84	-

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref	Chr. ref.	QM
5	Seaweed, dried (British Columbi) (Porphyra perforata)	leaves		10		678						113	HPLC	76.1	76	Hk
9	Senposai Gam-so-tsai (Taiwan) ()	(mature)									1728	[p]	OCC	71	71	Rk
10	Serralha, raw (Brazil) (Sonchus oloeraceus)	leaves (mature)				6300				310	24000	1050	OCC	67	67.7	Rk
3	Sesbania (Thailand) (Sesbania grandiflora)	leaves	46	78.1		2237						373	HPLC	73	73	Hc
6	Sesbania (Malaysia) (Sesbania grandiflora)				0	13611	0	20213	0			2269	HPLC	71 1	06	Hk
3	Sesbania (Thailand) (Sesbaniz roxburghii)	yellow flower	50	87.7		205						34	HPLC	73	73	Hc
3	Sesbania (Thailand) (Sesbanis grandiflora)	flower	75	89.3		3						1	HPLC	73	73	Hc
9	Shallot (Taiwan) (Allium ascalonicum)	(mature)									768	[p]	OCC	71	71	Rk
58	Shallot, fresh (Australia) (Allium fistulosum)	bulb	72	92.8	20	740	80					132	OCC	72 1	72.1	Rk
43	Sharisha phool, raw leafy type (Bangladesh) (Brassica campestris)	flower				8800 (8440-9660)						1467	OCC	43	43	Rk
70	Shepherd's-Purse, raw (China) (Capsella bursa-pastoris)		80	85.1							3200	0	OCC	70	70	Rn
52	Shepu, raw (India) (Peucedanum graveolens)					3026						504	HPLC	52	52	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

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57	Silverbeet, fresh (Australia) (Beta vulgaris cicla)	leaf, stem	88	93.7	10	420	20					73	OCC	72 1	72.1	Rk
87	Silverbeet, raw (New Zealand) (Beta vulgaris)		73	90.6	0	3173						529	HPLC	87	87	Hn
94	Silverbeet, raw (Australia) (Beta vulgaris)				0	5600			< 30			930	HPLC	94	94	Hc
5	Silverweed, cooked (British Columbi) (Potentilla pacifica)	roots (mature)		66		1						0	HPLC	76.1	76	Hk
3	Snake gourd (Thailand) (Trichosanthes anguina)		93	94.3		11						2	HPLC	73	73	Hc
6	Snake gourd (Malaysia) (Trichosanthes anguina)				0	148	0	225	0			25	HPLC	71 1	06	Hk
9	Snap beans Black creasback (Taiwan) (Phaseolus vulgaris)	leaves (mature)									5310	[p]	OCC	71	71	Rk
9	Snap beans (Taiwan) (Phaseolus vulgaris)	(mature)									108	[p]	OCC	71	71	Rk
9	Snow peas (Taiwan) (Pisum sativum)	(mature)									150	[p]	OCC	71	71	Rk
84	Sorrel leaf (CIS) ()										2500	[p]	unknown	84	84	-
85	Soup, spinach, dehydrated (Croatia) ()					3750					3750	[p]	OCC	85	85	Rn
85	Soup, tomato, dehydrated (Croatia) ()					850					3330	[p]	OCC	85	85	Pn

Carotenoid content of food (µg/100g edible portion, fresh weight)

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85	Soup, vegetable, dehydrated (Croatia) ()					350					1000	[p]	OCC	85	85	Rn
34	Soya (Japan) (Glycine max)	leaves				6963		4623			13760	[p]	HPLC	34	34	Hn
3	Soybean (Thailand) (Glycine max)		100	11.4		24						4	HPLC	73	73	Hc
47	Soybean (Vietnam) (Soja hispida)										230	[p]	HPLC/OCC	71	71	Hn
70	Soybeans, raw (China) (Glycine max)	seeds, with pod	44								225	0	OCC	70	70	Rn
70	Soybeans, raw (China) (Glycine max)	sprouts	95								90	0	OCC	70	70	Rn
9	Soybean, vegetable (Taiwan) (Glycine max)	(mature)									228	[p]	OCC	71	71	Rk
3	Spanish plum (Thailand) (Sapondias dulcis)		60	85.6		50						8	HPLC	73	73	Hc
83	Spearmint (Mexico) (Menta sativa)										6600	[p]	unknown	83	83	O
1	Spinach, raw (Spain) (Spinacea oleracea)	leaves (mature)	76	91.6	ND	3254	ND	4929	ND	377		542	HPLC	74 2	01	Hb
1	Spinach, cooked (10 min) (Spain) (Spinacea oleracea)	leaves (mature)	76	91.7	ND	4626	ND	6422	ND	564		771	HPLC	74.2	01	Hb
2	Spinach (Guatemala) (Spinacea oleracea)					2860						477	HPLC	78	78.2	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

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6	Spinach (Malaysia) (Amaranthus viridis)				0	3177	0	4175	0			530	HPLC	71.1	06	Hk
8	Spinach (Malaysia) (Amaranthus viridis)	leaves (mature)			0	3180		4180				530	HPLC	71.3	06	Hk
9	Spinach South Asia (Taiwan) (Spinacea oleracea)	(mature)									2838	[p]	OCC	71	71	Rk
9	Spinach (Taiwan) (Spinacea oleracea)	(mature)									3726	[p]	OCC	71	71	Rk
9	Spinach Spark (Taiwan) (Spinacea oleracea)	(mature)									3216	[p]	OCC	71	71	Rk
31	Spinach, cooked (Pakistan) (Spinacea oleracea)					2500						417	OCC	71.4	71 1	Rz
26	Spinach, raw (Egypt) (Spinacea oleracea)				0	5311						885	HPLC	74	74	Hk
42	Spinach, steamed (USA) (Spinacea oleracea)	leaves (mature)				9860		10600				1643	HPLC	42	42	Hb
42	Spinach, raw (USA) (Spinacea oleracea)	leaves (mature)				8900		9500				1483	HPLC	42	42	Hb
31	Spinach, raw (Pakistan) (Spinacea oleracea)					3330						555	OCC	71 4	71 1	Rz
44	Spinach (Hungary) (Spinacea oleracea)	leaves				6110						1018	HPLC	44	44	Hk
52	Spinach, raw (India) (Spinacea oleracea)					5531						922	HPLC	52	52	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

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57	Spinach, fresh '102' (Australia) (Spinacea oleracea)	leaf, stem	74	93.5	110	2220	70					386	OCC	72.1	72.1	Rk
70	Spinach, raw (China) (Spinacea oleracea)		91	91.1							3272 (2920-3870)	0	OCC	70	70	Rn
77	Spinach, raw (U.K.) (Spineacia oleracea)	no ribs/stems	81	89.7	0	3515	35					589	HPLC	77	67	Hk
80	Spinach (Nepal) (Spinacea oleracea)					3049						508	HPLC	80	80	Hn
77	Spinach, boiled [g] (U.K.) (Spineacia oleracea)	no ribs/stems	100	91.8	0	3820	39					640	HPLC	77	67	Hk
79	Spinach, raw (India) (Spinacea oleracea)					2740						457	HPLC	79		Hn
84	Spinach, raw (CIS) (Spinacia oleracea)										4500	[p]	unknown	84	84	-
85	Spinach, raw (Croatia) (Spinacia oleracea)					15800					15800	[p]	OCC	85	85	Rn
90	Spinach, raw (Ethiopia) (Spinacea oleracea)					5770						962	Spectr.	90	90	O
91	Spinach, cooked (Netherlands) (Spinacea oleracea)					840						140	HPLC	91	91	Hc
90	Spinach, boiled (Ethiopia) (Spinacea oleracea)					4530						755	Spectr.	90	90	O
94	Spinach, raw (Australia) (Spinacia oleracus)				0	3760			< 30			630	HPLC	94	94	Hc

Carotenoid content of food (µg/100g edible portion, fresh weight)

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6	Spinach, red (Malaysia) (Amaranthus gangeticus)				0	5088	0	2047	0			848	HPLC	71.1	06	Hk
18	Spinach, wild, dried (Dominican Repub) ()			10.5	2470	24070						4227	HPLC	74	-	Hn
34	Spindle tree (Japan) (Euonymus japonica)	leaves				1823		2157			6308	[p]	HPLC	34	34	Hn
34	Spindle tree (Japan) (Eronymus japonica)	leaves				2724		3324			7895	[p]	HPLC	34	34	Hn
3	Sponge gourd (Thailand) (Luffa cylindrica)		89	92.8		8						1	HPLC	73	73	Hc
3	Sponge gourd (Thailand) (Luffa cylindrica)	leaves	35	88.5		391						65	HPLC	73	73	Hc
3	Sponge gourd (Thailand) (Luffa cylindrica)	flower	48	87.6		522						87	HPLC	73	73	Hc
9	Sponge gourd King men (Taiwan) (Luffa cylindrica)	(mature)									96	[p]	OCC	71	71	Rk
9	Sponge gourd Seven beauty (Taiwan) (Luffa cylindrica)	(mature)									48	[p]	OCC	71	71	Rk
9	Sponge gourd Angled (Taiwan) (Luffa cylindrica)	(mature)									108	[p]	OCC	71	71	Rk
9	Sponge gourd (Taiwan) (Luffa cylindrica)	(mature)									60	[p]	OCC	71	71	Rk
47	Sponge gourd (Vietnam) (Luffa cylindrica)										100	[p]	HPLC/OCC	71	71	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

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77	Spring greens, raw (U.K.) (Brassica oleracea)		74	86.2	0	2615	26					438	HPLC	77	67	Hk
77	Spring greens, boiled (12 min) (U.K.) (Brassica oleracea)		100	92.2	0	2255	23					378	HPLC	77	67	Hk
91	Spring greens, cooked (Netherlands) (B. oleracea capitata)					110						18	HPLC	91	91	Hc
6	Spring onion (Malaysia) (Allium fistulosum)				0	1282	0	323	0			214	HPLC	71.1	06	Hk
47	Spring onion (Vietnam) (Allium fistulosum)										1770	[p]	HPLC/OCC	71	71	Hn
1	Squash, cooked (15 min) (Spain) (Cucurbita pepo)	pulp, seeds (mature)	79	94.5	ND	26	0	118	ND			4	HPLC	74.2	01	Hb
1	Squash, raw (Spain) (Cucurbita pepo)	pulp, seeds (mature)	79	94.6	ND	23	0	100	ND			4	HPLC	74.2	01	Hb
3	Squash (Thailand) (Cucurbita maxima)	flower	54	94.8		103						17	HPLC	73	73	Hc
18	Squash, dried (Mali) (Cucurbita)			9.09	7500	4560						1413	HPLC	74	-	Hn
22	Squash, raw Menina Verde (Brazil) (Cucurbita moschata)	pulp (immature)			tr	20		10				3	OCC	67	67	Rk
22	Squash, raw Menina Verde (Brazil) (Cucurbita moschata)	fruit (whole) (immature)			tr	100		70				17	OCC	67	67	Rk
19	Squash, raw Bataninha (Brazil) (Cucurbita moschata)	fruit (mature)			4710 (1680-8250)	23460 (12540-29440)		850 (480-1450)		ND		4320	OCC	67	67	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr ref.	QM
22	Squash, raw Menina Verde (Brazil) (Cucurbita moschata)	fruit (mature)			2300 (830-4230)	3930 (1410-7930)		230 (tr-640)				855	OCC	67	67	Rk
22	Squash, raw Menina Verde (Brazil) (Cucurbita moschata)	fruit (immature)			10 (tr-20)	150 (80-250)		300 (70-740)				26	OCC	67	67	Rk
31	Squash, raw (Pakistan) (Citrullus fistulosus)					1910						318	OCC	71.4	71 1	Rz
30	Squash, cooked Acorn (USA) (Cucurbita pepo)	fruit (mature)				490		660				82	HPLC	30	30	Hk
31	Squash, cooked (Pakistan) (Citrullus fistulosus)					950						158	OCC	71.4	71 1	Rz
59	Squash, fresh button type (Australia) (Cucurbita pepo)	whole fruit	100	91.1	20	140	200					43	OCC	72.1	72 1	Rk
59	Squash, fresh Scallopini (Australia) (Cucurbita pepo)	whole fruit	100	93.7	40	600	110					114	OCC	72.1	72.1	Rk
70	Squash, raw 'south squash' (China) (Cucurbita spp)	seedlings	30	92.6							1130	0	OCC	70	70	Rn
70	Squash, raw 'south squash' (China) (Cucurbita spp.)	vine tips	90	90.8							860	0	OCC	70	70	Rn
70	Squash, raw 'south squash' (China) (Cucurbita spp.)	flowers	80	94.1							620	0	OCC	70	70	Rn
70	Squash, raw (China) (Cucurbita spp)	pulp	88	93.1							1571 (200-3200)	0	OCC	70	70	Rn
82	Squash, fresh (Egypt) (Cucurbita pepo)										4600	[p]	OCC	71	71	Rn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
87	Squash, raw (New Zealand) (Cucurbita maxima)			83 7	0	3179						530	HPLC	87	87	Hn
18	Squash puree, dried (Mali) ( )				7480	9130						2172	HPLC	74	-	Hn
87	Squash, butternut, raw (New Zealand) (Cucurbita maxima)	flesh	79	86.4	0	3471						579	HPLC	87	87	Hn
87	Squash, hybrid, raw (New Zealand) (Cucurbita maxima)	flesh	69	81.0	0	2563						427	HPLC	87	87	Hn
70	Squash, tender, raw 'bamboo shoot squash' (China) (Cucurbita spp)	pulp	79	95.5							55 (0-210)	0	OCC	70	70	Rn
22	Squash/pumpkin, raw Caserta (Brazil) (Cucurbita pepo)	fruit (whole) (immature)				150		100				25	OCC	67	67	Rk
22	Squash/pumpkin, raw Caserta (Brazil) (Cucurbita pepo)	fruit (immature)				140 (130-160)		460 (100-620)				23	OCC	67	67	Rk
22	Squash/pumpkin, raw Caserta (Brazil) (Cucurbita pepo)	pulp (immature)				30		30				5	OCC	67	67	Rk
80	Stinging nettle (Nepal) (Urtoca dioca)					4595						766	HPLC	80	80	Hn
3	Stink weed (Thailand) (Eryngium floridanum)		90	85.3		5202						867	HPLC	73	73	Hc
3	Sugar pea (Thailand) (Pisum sativum)	young pod	88	88.4		70						12	HPLC	73	73	Hc
3	Swamp cabbage (Thailand) (Ipomoea reptans)	white stem	81	94.0		1222						204	HPLC	73	73	Hc

Carotenoid content of food (µg/100g edible portion, fresh weight)

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3	Swamp cabbage (Thailand) (Ipomoea reptans)	red stem	66	92.3		593						99	HPLC	73	73	Hc
6	Swamp cabbage (Malaysia) (Ipomoea aquatica)				0	1595	0	335	0			316	HPLC	71.1	06	Hk
86	Swamp cabbage, fried (Indonesia) (Ipomoea reptans)	leaves				143						24	HPLC	86	86	Hn
86	Swamp cabbage, fresh (Indonesia) (Ipomoea reptans)				36	1263						214	HPLC	86	86	Hn
86	Swamp cabbage, dried (Indonesia) (Ipomoea reptans)	leaves			715	9293						1611	HPLC	86	86	Hn
86	Swamp cabbage, stewed (Indonesia) (Ipomoea reptans)	leaves				209						35	HPLC	86	86	Hn
96	Swede, raw, peeled (Australia) (B. napus napobrassica)				0	0	0					0	HPLC	96	96	Hn
3	Sweet basil (Thailand) (Ocimum basilicum)	leaves	43	87.9		2712						452	HPLC	73	73	Hc
9	Sweet corn (Taiwan) (Zea mays)	(mature)									966	[p]	OCC	71	71	Rk
59	Sweet corn, fresh (Australia) (Zea mays)	kernels	67	70.6	100	200	20					44	OCC	72.1	72.1	Rk
47	Sweet majoram (Vietnam) (Elsholtzia cristata)										5050	[p]	HPLC/OCC	71	71	Hn
9	Sweet pepper (Taiwan) (Capsicum annuum)	(mature)									288	[p]	OCC	71	71	Rk

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext ref	Chr ref.	QM
3	Sweet pepper, green (Thailand) (Capsicum annuum)		90	91.4		53						9	HPLC	73	73	Hc
91	Sweet pepper, red, cooked (Netherlands) (Capsicum annuum)					1030						172	HPLC	91	91	Hc
2	Sweet potato (Guatemala) (Ipomoea batatas)					2960						493	HPLC	78	78.2	Hn
3	Sweet potato (Thailand) (Ipomoea batatus)	leaves	55	84.7		5175						863	HPLC	73	73	Hc
3	Sweet potato orange yellow (Thailand) (Ipomoea batatus)		77	77.2		1050						175	HPLC	73	73	Hc
9	Sweet potato White (Taiwan) (Ipomoea batatas)	(mature)									126	[p]	OCC	71	71	Rk
24	Sweet potato, raw (South Pacific) (Ipomoea batatas)	root				86						14	HPLC	24	24	Hk
9	Sweet potato Red (Taiwan) (Ipomoea batatas)	(mature)									7050	[p]	OCC	71	71	Rk
24	Sweet potato, raw (South Pacific) (Ipomoea batatas)	root				47						8	HPLC	24	24	Hk
9	Sweet potato TN 64 (Taiwan) (Ipomoea batatas)	(mature)									6420	[p]	OCC	71	71	Rk
9	Sweet potato AIS 35-2 (Taiwan) (Ipomoea batatas)	(mature)									2568	[p]	OCC	71	71	Rk
26	Sweet potato, raw (Egypt) (Ipomoea batatas)				0	6418						1070	HPLC	74	74	Hk

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext ref	Chr. ref.	QM
32	Sweet potato Jewel (USA) (Ipomoea batatas)	root (mature)									5000	[p]	Spectr	32	32	0
32	Sweet potato Centennial (USA) (Ipomoea batatas)	root (mature)									9500	[p]	Spectr.	32	32	0
32	Sweet potato Jasper (USA) (Ipomoea batatas)	root (mature)									5400	[p]	Spectr	32	32	0
32	Sweet potato Travis (USA) (Ipomoea batatas)	root (mature)									6300	[p]	Spectr.	32	32	0
49	Sweet potato, raw white fleshed (Brazil) (Ipomoea batatas)	root				61						10	OCC	67	67 1	Rk
49	Sweet potato, cooked white fleshed (Brazil) (Ipomoea batatas)	root				45						8	OCC	67	67 1	Rk
58	Sweet potato, fresh orange flesh (Australia) (Ipomoea batatas)	tuber	90	78.7	50	6600	300					1132	OCC	72 1	72 1	Rk
58	Sweet potato, fresh white flesh (Australia) (Ipomoea batatas)	tuber	92	81.4	20	10	0					3	OCC	72 1	72 1	Rk
58	Sweet potato, fresh purple skin (Australia) (Ipomoea batatas)	tuber	92	75 0	20	10	0					3	OCC	72 1	72 1	Rk
70	Sweet potato, raw (China) (Ipomoea batatas)	leaves	80	90.0							6420	0	OCC	70	70	Rn
70	Sweet potato, raw (China) (Ipomoea batatas)	vine tips	90	89.5							3200	0	OCC	70	70	Rn
70	Sweet potato, raw (China) (Ipomoea batatas)		87	67.1							1310 (90-5510)	0	OCC	70	70	Rn

Carotenoid content of food (µg/100g edible portion, fresh weight)

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79	Sweet potato, raw (India) (Ipomoea batatas)					1810						302	HPLC	79		Hn
80	Sweet potato (Nepal) (Ipomoia batatus)					21						4	HPLC	80	80	Hn
84	Sweet potato, raw (CIS) (Ipomoea batatas)										300	[p]	unknown	84	84	-
94	Sweet potato, raw (Australia) (Ipomoea batatas)				0	22680			< 30			3780	HPLC	94	94	Hc
9	Sweet potato tips AIS 35 (Taiwan) (Ipomoea batatas)	(mature)									1110	[p]	OCC	71	71	Rk
9	Sweet potato tips TN 64 (Taiwan) (Ipomoea batatas)	(mature)									1068	[p]	OCC	71	71	Rk
9	Sweet potato tips (Taiwan) (Ipomoea batatas)	(mature)									1146	[p]	OCC	71	71	Rk
86	Sweet potato, orange, fried (Indonesia) (Ipomoea potatos)				71	739						129	HPLC	86	86	Hn
86	Sweet potato, orange, steamed (Indonesia) (Ipomoea potatos)					155						26	HPLC	86	86	Hn
86	Sweet potato, orange, fresh (Indonesia) (Ipomoea potatos)				119	736						133	HPLC	86	86	Hn
86	Sweet potato, orange, dried (Indonesia) (Ipomoea potatos)	leaves			715	10938						1885	HPLC	86	86	Hn
47	Sweet potato, pale (Vietnam) (Ipomoea batatas)										0	[p]	HPLC/OCC	71	71	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

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47	Sweet potato, yellow (Vietnam) (Ipomoea batatas)										1360	[p]	HPLC/OCC	71	71	Hn
90	Swiss chard, boiled (Ethiopia) (Beta vulgaris cicla)					2190						365	Spectr	90	90	O
90	Swiss chard, raw (Ethiopia) Beta vulgaris cicla)					3060						510	Spectr.	90	90	O
10	Taioba, raw (Brazil) (Xanthosoma spp.)	leaves (mature)				6700				270	28100	1117	OCC	67	67 7	Rk
3	Tamarind (Thailand) (Tamarindus indica)	young pod	68	77.2		47						8	HPLC	73	73	Hc
3	Tamarind (Thailand) (Tamarindus indica)	leaves	80	75.0		228						38	HPLC	73	73	Hc
6	Tanki (Malaysia) (Neptunia oleracea)				0	11395	0	6236	0			1899	HPLC	71.1	06	Hk
3	Tao (Thailand) ()		95	95.5		906						151	HPLC	73	73	Hc
6	Tapioca shoots (Malaysia) (Manihot utilissima)				0	5720	0	1676	0			953	HPLC	71 1	06	Hk
24	Taro, raw (South Pacific I) (Xanthosoma sagittifolium)	root				13						2	HPLC	24	24	Hk
24	Taro, raw (South Pacific I) (Colocasia esculenta)	root				43						7	HPLC	24	24	Hk
24	Taro, raw (South Pacific I) (Xanthosoma sagittifolium)	root				29						5	HPLC	24	24	Hk

Carotenoid content of food (µg/100g edible portion, fresh weight)

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24	Taro, raw (South Pacific I) (Colocasia esculenta)	root				43						7	HPLC	24	24	Hk
9	Taro Water taro (Taiwan) (Colocasia esculenta,	leaves (mature)									6096	[p]	OCC	71	71	Rk
58	Taro, fresh (Australia) (Colocasia esculenta)	corm	90	68.9	0	20	20					5	OCC	72 1	72.1	Rk
70	Taro, raw (China) (Colocasia esculenta)	leaf stalk	90	94.0							150	0	OCC	70	70	Rn
70	Taro, raw (China) (Colocasia esculenta)		85	78.8							20	0	OCC	70	70	Rn
86	Taro, boiled (Indonesia) (Colocasia esculenta)	leaves				71						12	HPLC	86	86	Hn
86	Taro, boiled (Indonesia) (Colocasia esculenta)	leaves				95						16	HPLC	86	86	Hn
86	Taro, dried (Indonesia) (Colocasia esculenta)	leaves			672	17920						3045	HPLC	86	86	Hn
86	Taro, fresh (Indonesia) (Colocasia esculenta)	leaves			95	1811						310	HPLC	86	86	Hn
79	Tellagarfelikura, raw (India) ()					210						35	HPLC	79		Hn
6	Terung pipit (Malaysia) (Solanum torvum)				0	74	0	154	0			12	HPLC	71 1	06	Hk
43	Thankuni sak, cooked leafy type (Bangladesh) (Centella asiatica)					6100 (6020-6270)						1017	OCC	43	43	Rk

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5	Thimbleberry, raw (British Columbi) (Rubus parviflorus)	shoots (peeled)		93		25						4	HPLC	76 1	76	Hk
47	Thyme (Vietnam) (Polygonum odoratum)										4200	[p]	HPLC/OCC	71	71	Hn
1	Tomato, raw Canary Islands type (Spain) (Solanum lycopersicum)	fruit (mature)	95	93 6	ND	443	ND	44	1604			77	HPLC	74.2	01	Hb
1	Tomato, raw pear type (Spain) (Solanum lycopersicum)	fruit (mature)	95	93.6	ND	393	ND	72	62273			78	HPLC	74 2	01	Hb
1	Tomato, raw common type (Spain) (Solanum lycopersicum)	fruit (mature)	97	93 6	ND	494	ND	52	2116			93	HPLC	74.2	01	Hb
3	Tomato (Thailand) (Lycopersicum esculentum)		98	93 9		391						65	HPLC	73	73	Hc
6	Tomato (Malaysia) (Lycopersicum esculentum)				0	365	0	130	0			61	HPLC	71 1	06	Hk
8	Tomato (Malaysia) (Lycopersicum esculentum)	fruit (mature)			0	365		130				61	HPLC	71.3	06	Hk
20	Tomato, raw Santa Cruz (Brazil) (Lycopersicum esculentum)					640						107	HPLC	67	67.2	Rk
14	Tomato, raw (Brazil) (Lycopersicum esculentum)	fruit (ripe)				506						90	OCC	14	14	Rc
9	Tomato (Taiwan) (Colocasia esculenta)	(mature)									498	[p]	OCC	71	71	Rk
17	Tomato (Brazil) (Lycopersicum esculentum)					450			2080		2610	81	OCC	67	67.5	Rk

Carotenoid content of food (µg/100g edible portion, fresh weight)

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18	Tomato, dried (Mali) (Lycopersicum esculentum)			6.45	< 60	2060						349	HPLC	74	-	Hn
30	Tomato, raw (USA) (Lycopersicum esculentum)	fruit (mature)				500			6700			83	HPLC	30	30	Hk
42	Tomato, raw (USA) (Lycopersicum esculentum)	fruit (mature)				280		130	3920			47	HPLC	42	42	Hb
42	Tomato, stewed (8 min.) (USA) (Lycopersicum esculentum)	fruit (mature)				570		740				95	HPLC	42	42	Hb
36	Tomato, raw (USA) (Lycopersicum esculentum)	fruit (ripe)				170						28	HPLC	36	36	Hk
47	Tomato (Vietnam) (Solanum melongena)										480	[p]	HPLC/OCC	71	71	Hn
52	Tomato, raw (India) (Lycopersicum esculentum)					619						103	HPLC	52	52	Hk
70	Tomato, raw (China) (Lycopersico lycopersicum)		95	94.8							362 (110-580)	0	OCC	70	70	Rn
69	Tomato, fresh Santa Cruz (Brazil, Campina) (Lycopersicum esculentum)	whole fruit (ripe)				510			3110		4140	[p]	OCC	67	67.9	Rk
80	Tomato (Nepal) (Lycopersicum esculentum)					260						43	HPLC	80	80	Hn
79	Tomato, raw (India) (Lycopersicon esculentum)					590						98	HPLC	79		Hn
84	Tomato, raw (CIS) (Lycopersicum esculentum)										1200	[p]	unknown	84	84	-

Carotenoid content of food (µg/100g edible portion, fresh weight)

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84	Tomato, preserved (CIS) (Lycopersicum esculentum)										1000	[p]	unknown	84	84	-
84	Tomato, pickled (CIS) (Lycopersicum esculentum)										300	[p]	unknown	84	84	
85	Tomato, canned (Croatia) (Lycopersicon esculentum)					3630					12060	[p]	OCC	85	85	Rn
84	Tomato (CIS) (Lycopersicum esculentum)	juice									500	[p]	unknown	84	84	-
84	Tomato, paste (CIS) (Lycopersicum esculentum)										2000	[p]	unknown	84	84	-
84	Tomato, catsup (CIS) (Lycopersicum esculentum)										1200	[p]	unknown	84	84	-
91	Tomato, raw (Netherlands) (Lycopersicon esculentum)					840						140	HPLC	91	91	Hc
87	Tomato, raw (New Zealand) (Lycopersicon esculentum)		100	94.2	0	549						92	HPLC	87	87	Hn
90	Tomato, boiled (Ethiopia) (Lycopersicon esculentum)					1850						308	Spectr	90	90	O
94	Tomato, raw (Australia) (Lycopersicon esculentum)				0	410			6160			70	HPLC	94	94	Hc
14	Tomato juice, processed Brand A (Brazil) (Lycopersicon lycopersicum)	pulp				364						61	OCC	14	14	Rc
91	Tomato juice (Netherlands) (Lycopersicon esculentum)	juice				260						43	HPLC	91	91	Hc

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14	Tomato ketchup, processed avg 2 brands (Brazil) (Lycopersicon lycopersicum)	pulp				582						97	OCC	14	14	Rc
14	Tomato paste, processed avg 2 brands (Brazil) (Lycopersicon lycopersicum)	pulp				937						156	OCC	14	14	Rc
14	Tomato puree, processed avg 2 brands (Brazil) (Lycopersicon lycopersicum)	pulp				753						126	OCC	14	14	Rc
96	Tomato, cherry, raw (Australia) (Lycopersicon esculentum)				20	460	40					82	HPLC	96	96	Hn
96	Tomato, common, raw (Australia) (Lycopersicon esculentum)				10	330	20					58	HPLC	96	96	Hn
96	Tomato, egg, raw (Australia) (Lycopersicon esculentum)				10	270	20					48	HPLC	96	96	Hn
70	Tomato, pale green, raw (China) (Lycopersicon lycopersicum)	(mature)	100	94.3							150	0	OCC	70	70	Rn
70	Tomato, pink, raw (China) (Lycopersicon lycopersicum)		94	95.5							350	0	OCC	70	70	Rn
70	Tomato, red, raw (China) (Lycopersicon lycopersicum)		97	95.9							370	0	OCC	70	70	Rn
70	Tomato, yellow, raw (China) (Lycopersicon lycopersicum)		92	95.5							250	0	OCC	70	70	Rn
3	Toon (Thailand) ()		77	95.6		36						6	HPLC	73	73	Hc
79	Tulasi, raw (India) (Ocimum sanctum)					815						136	HPLC	79		Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr ref	QM
79	Tummikura, raw (India) (Leucas aspera)					4250						708	HPLC	79		Hn
2	Turnip (Guatemala) (Brassica rapa)					7430						1238	HPLC	78	78.2	Hn
82	Turnip, fresh (Egypt) (Brassica rapa)	root									0	[p]	OCC	71	71	Rn
82	Turnip, fresh (Egypt) (Brassica rapa)	leaves									26000	[p]	OCC	71	71	Rn
80	Turnip (Nepal) (Brassica rapa)					2						0	HPLC	80	80	Hn
84	Turnip, raw (CIS) (Brassica rapa)										100	[p]	unknown	84	84	-
70	Turnip greens, raw (China) (Brassica rapa)	greens	91	91.0							1100	0	OCC	70	70	Rn
80	Turnip leaves (Nepal) (Brassica rapa)	leaves				2316						386	HPLC	80	80	Hn
31	Turnip, green, cooked (Pakistan) (Brassica napus)					220						37	OCC	71 4	71 1	Rz
31	Turnip, green, raw (Pakistan) (Brassica napus)					330						55	OCC	71.4	71 1	Rz
96	Turnip, white, raw, peeled (Australia) (Brassica napus)				0	0	0					0	HPLC	96	96	Hn
31	Turnip, yellow, cooked (Pakistan) (Brassica napus)					220						37	OCC	71.4	71.1	Rz

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref	Chr. ref.	QM
31	Turnip, yellow, raw (Pakistan) (Brassica napus)					270						45	OCC	71.4	71.1	Rz
2	Tziton (Guatemala) (Tinantia erecta)					5050						842	HPLC	78	78.2	Hn
79	Uttareni, raw (India) (Achyranthes aspera)					4060						677	HPLC	79		Hn
31	Vegetable sponge, raw (Pakistan) (Luffa acutangula)					390						65	OCC	71.4	71.1	Rz
31	Vegetable sponge, cooked (Pakistan) (Luffa acutangula)					350						58	OCC	71 4	71 1	Rz
85	Vegetables, mixed (Croatia) ()					2350					11980	[p]	OCC	85	85	Rn
3	Vine Spinach (Thailand) (Basella rubra)		62	92.3		2904						484	HPLC	73	73	Hc
70	Vinespinach, raw (China) (Basella alba)		98	92.7							4550	0	OCC	70	70	Rn
9	Water bamboo (Taiwan) (Zizania palustris)	(mature)									228	[p]	OCC	71	71	Rk
37	Water convolvulus, fresh (Taiwan) (Ipomoea aquatica)	leaves				10000		7800				1667	HPLC	37	37	Hb
80	Water cress (Nepal) (Nasturium officinale)					4356						726	HPLC	80	80	Hn
3	Water dropwort (Thailand) (Eryngium foetidum)	leaves	78	88.8		1529						255	HPLC	73	73	Hc

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
47	Water dropwort (Vietnam) (Oenanthe stolonifera)										1770	[p]	HPLC/OCC	71	71	Hn
3	Water mimosa (Thailand) (Neptunia oleracea)		54	86.6		2832						472	HPLC	73	73	Hc
40	Water spinach, raw (Australia) (Ipomoea aquatica)	leaf, stem (mature)	100		30	1180	35					202	OCC	72.[1]	72 1	Rk
47	Water spinach (Vietnam) (Ipomoea aquatica)										3420	[p]	HPLC/OCC	71	71	Hn
70	Waterchestnut, raw (China) (Eleocharis spp.)		69	74.3							5 (tr-10)	0	OCC	70	70	Rn
2	Watercress (Guatemala) (Nasturtium officinale)					3130						522	HPLC	78	78.2	Hn
40	Watercress, raw (Australia) (Rorippa nasturtium-aqua.)	leaf, stem (mature)	100		20	1980	40					335	OCC	72.1	72.1	Rk
47	Watercress (Vietnam) (Nasturtium officinale)										3250	[p]	HPLC/OCC	71	71	Hn
87	Watercress, raw (New Zealand) (Rorippa nasturtium aquat.)		41	93.0	0	4945						824	HPLC	87	87	Hn
3	Watermelon (Thailand) (Citrullus vulgaris)		59	92.6		365						61	HPLC	73	73	Hc
70	Watermelon, raw (China) (Citrullus lanatus lanatus)		55	93.8							146 (10-410)	0	OCC	70	70	Rn
70	Water-convolvulus, raw (China) (Ipomoea aquatica)		76	90.3							2245 (1800-3350)	0	OCC	70	70	Rn

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext. ref.	Chr. ref.	QM
2	Wax beans (Guatemala) (Phaseolus vulgaris)					9820		0				1637	HPLC	78	78 2	Hn
9	Wax gourd (Taiwan) (Benincasa hispida)	(mature)									66	[p]	OCC	71	71	Rk
40	Wax gourd, raw (Australia) (Benincasa hispida)	fruit (large) (mature)	68		20	10	0					3	OCC	72.1	72.1	Rk
70	Wax-gourd, raw (China) (Benincasa hispida)		78	97.0							0	0	OCC	70	70	Rn
9	Welsh onion (Taiwan) (Allium fistulosum)	(mature)									1938	[p]	OCC	71	71	Rk
91	White cabbage, cooked (Netherlands) (B oleracea capitata)					0						0	HPLC	91	91	Hc
3	Wild ginger (Thailand) (Kaempteria pandurata)		75	93.7		0						0	HPLC	73	73	Hc
9	Winged bean (Taiwan) (Psophocarpus tetragon.)	root (mature)									0	[p]	OCC	71	71	Rk
9	Winged bean (Taiwan) (Psophocarpus tetragon)	(mature)									378	[p]	OCC	71	71	Rk
9	Winged bean (Taiwan) (Psophocarpus tetragon.)	leaves (mature)									4860	[p]	OCC	71	71	Rk
80	Winged bear leaves (Nepal) (Psophocarpus tetragon.)	leaves				13135						2189	HPLC	80	80	Hn
6	Wolfberry leaves (Malaysia) (Lycium chinense)				0	5867	0	7591	0			978	HPLC	71.1	06	Hk

Carotenoid content of food (μg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ. method	Ext ref.	Chr. ref	QM
8	Wolfberry leaves (Malaysia) (Lycium chinense)	leaves (mature)			0	5870		7590				978	HPLC	71 3	06	Hk
24	Yam, raw (South Pacific I) (Dioscorea esculenta)	root				103						17	HPLC	24	24	Hk
24	Yam, raw (South Pacific I) (Dioscorea esculenta)	root				37						6	HPLC	24	24	Hk
24	Yam, raw (South Pacific I) (Dioscorea alata)	root				80						13	HPLC	24	24	Hk
24	Yam, raw (South Pacific I) (Dioscorea alata)	root				110						18	HPLC	24	24	Hk
70	Yam, raw (China) (Dioscorea spp)		95	82.6							20	0	OCC	70	70	Rn
6	Yam stalks (Malaysia) (Dioscorea spp)				0	61	0	80	0			10	HPLC	71.1	06	Hk
80	Yarba-de-tega (Nepal) ()					3532						589	HPLC	80	80	Hn
3	Yard long beans, green (Thailand) (Vigna sinensis)		92	90.0		66						11	HPLC	73	73	Hc
3	Yard long beans, green (Thailand) (Vigna sinensis)	leaves	43	88.7		276						46	HPLC	73	73	Hc
9	Yardlong bean (Taiwan) (Vigna unguiculata)	(mature)									198	[p]	OCC	71	71	Rk
86	Yardlong bean, fresh (Indonesia) (Vigna unguilata)				0	143						24	HPLC	86	86	Hn

Carotenoid content of food (µg/100g edible portion, fresh weight)

Ref	Food description Variety (country) (Scientific name)	Part of plant or animal (Maturity)	EP	Mst (%)	α-carot (range)	β-carot (range)	β-crypto (range)	Lutein (range)	Lycopene (range)	Zeaxanth (range)	Total (range)	RE	Princ method	Ext ref	Chr ref	QM
86	Yardlong bean, dried (Indonesia) (Vigna unguilata)	leaves				465						78	HPLC	86	86	Hn
86	Yardlong bean, boiled (Indonesia) (Vigna unguilata)				24	113						21	HPLC	86	86	Hn
86	Yardlong bean, stewed (Indonesia) (Vigna unguilata)					95						16	HPLC	86	86	Hn
40	Yard long bean, raw (Australia) (Vigna sesquipedalis)	seed, pod (mature)	92		25	450	35					80	OCC	72.1	72.1	Rk
3	Ya-nang (Thailand) (Tiliacora triandra Diels)	leaves	60	69.9		3809						635	HPLC	73	73	Hc
3	Ya-nang (water extract) (Thailand) (Tiliacora triandra Diels)	leaves	100	99.4		535						89	HPLC	73	73	Hc
79	Yerramolakakura, raw (India) (Amaranthus spp.)					9760						1627	HPLC	79		Hn
59	Zucchini, fresh Blackjack (Australia) (Cucurbita pepo melopepo)	whole fruit	93	94.4	20	320	110					65	OCC	72.1	72.1	Rk
59	Zucchini, fresh white (Australia) (Cucurbita pepo melopepo)	whole fruit	94	94.2	30	230	60					46	OCC	72.1	72.1	Pk
59	Zucchini, fresh Golden (Australia) (Cucurbita pepo melopepo)	whole fruit	92	94.1	30	80	60					21	OCC	72.1	72.1	Rk

4. SUMMARY OF METHODS USED FOR THE ANALYSIS OF CAROTENOIDS

Abbreviations and terms used

absorb.	Absorbence
ACN	Acetonitrile
CH2Cl2	Dichloromethane
co-chr.	Co-chromatography
CR	Chemical reactions
BHT	Butylated hydroxytoluene
Fluor.	Fluorometry
HPLC	High-performance liquid chromatography
MeOH	Methanol
MS	Mass spectrometry
NMR	Nuclear magnetic resonance spectroscopy
OCC	Open column chromatography
ODS	Octadecylsilane
PE	Petroleum ether
QM	Quality measure
RT	Retention time
Spectr	Spectrophotometry
THF	Tetrahydrofuran
TLC	Thin layer chromatography

Note: The numbers in the ext ref and chrom.ref columns refer to the methods of extraction and chromatography respectively, as described in the original publications listed in Chapter 7. When a method used is based on an earlier published method this is indicated by giving the reference number of the initial method followed by a decimal point and a serial digit. For example, 67.4 in the column for chromatography indicates the fourth modification listed of the method described by Rodriguez et al. in reference 67.

SUMMARY OF METHODS USED FOR THE ANALYSIS OF CAROTENOIDS

	Reference	Reference Ext	Sap	Chr	Method	Column Name/size	Diam	Eluent composition/flow Type	Peak identification/ quantification	Internal standard	QM
01	Granado et al. (1992)	74	2 n	01	HPLC	Spheri-5 220x4 6	5 µ	ACN/CH2Cl2/MeOH (70 20 10), ACN/MeOH (85 15) isocr/grad 1 8 3 5 ml/mi	RT/stop flow scan, co-chr. absorbance	Echinenone, retinyl palmitate	Hb
02	Lopez-Palacios et al (1993)	78		78	2 HPLC						Hn
03	Sungpuag (1993)	73	y	73	HPLC	Hypersil 250x4 6	3 µ	MeOH/Ch3CN/ChCl3/H2O (200 250 90 11) isocratic 1 5 ml/min	RT peak height		Hc
04	Booth et al (1992)	71	n	75	1 HPLC	Novapak 150x3 9	4 µ	acetone/MeOH/THF (53 38 7) isocratic 2 ml/min	RT, absorb. peak height		Hk
05	Kuhnlein (1990)	76	1 y	76	HPLC	Spheri-5 250x4 6	5 µ	ACN/MeOH/H2O | ACN/MeOH/butan-1-ol gradient 2 ml/min	RT, chrom. behav peak area		Hk
06	Tee et al (1991)	71	1 y	06	HPLC	Bondapak 300x3 9	10 µ	ACN/MeOH/ethylacetate (88 10 2) isocratic 2 ml/min	RT peak area		Hk
07	Tee et al (1992A)	71	1 y	06	HPLC	Bondapak 300x3 9	10 µ	ACN/MeOH/ethylacetate (86 10 2) isocratic 2 ml/min	RT peak height		Hk
08	Tee et al (1992B)	71	3 y	06	HPLC	Bondapak 300x3 9	10 µ	ACN/MeOH/ethylacetate (88 10 2) isocratic 2 ml/min	RT peak area		Hk
09	Tsou (unpublished)	71		71	OCC			acetone/hexane	absorb		Rk
10	Mercadante et al (1990)	67	n	67.7	OCC			acetone in PE	TLC, absorb., CR absorbance		Rk
11	Cavalcante et al (1992)	67	y	67	OCC			acetone/ethyl ether	TLC, absorb , CR absorbance		Rk
12	Godoy et al (1990)	67	y	67.3	OCC			acetone/ethyl ether	TLC, absorb, co-chr., NMR, MR absorbance		Rc
13	Rodriguez Amaya et al (1983)	67	?	67	OCC			acetone/ethyl ether	TLC, absorb, CR, co-chr. absorbance		Rk
14	Podriguez-Amaya et al (1992)	14	n	14	OCC			acetone (2%), aceteone in PE (8%)	absorb chrom behav , NMR absorbance		Rc
15	Holland et al (1992)	77	y	77	HPLC	Zorbax	5 µ	ACN/CH2Cl2/MeOH (7:2:1) isocratic 1 3 ml/min	absorb absorbance		Hk
16	Kimura et al (1991)	67	n	67.6	OCC			acetone/ethyl ether	TLC, absorb , co-chr, CR absorbance		Rk
17	Kimura et al. (1990)	67	n	67.5	OCC			acetone/ethyl ether	TLC, absorb , co-chr, CR absorbance		Rk

SUMMARY OF METHODS USED FOR THE ANALYSIS OF CAROTENOIDS

Reference	Reference Ext	Sap	Chr	Method	Column Name/size Diam	Eluent composition/flow Type	Peak identification/ quantification	Internal standard	QM
18 Bushway (unpublished)	74	n	-	HPLC					Hn
19 Arima et al (1990)	67	y	67	OCC		ethyl ether/acetone/PE	TLC, absorb , CR absorbance		Rk
20 Carvalho et al (1992)	67	y	67 2	HPLC	Lichrocart 125x4 5 µ	MeOH/acetone (98 2) isocratic 0 8 ml/min	RT, spiking, TLC, absorb., CR peak height	Sudan I	Rk
21 Edwards et al (1986)	21	?	21	OCC			absorbance		Rn
22 Arima et al (1 38)	67	y	67	OCC		acetone/ethyl ether	TLC, absorb., CR, co-chr. absorbance		Rk
23 Trujillo-Quijano et al (1993)	23	y	14 1	OCC		acetone-PE | H2O-acetone | ether-PE	TLC, absorb, CR absorbance		Rk
24 Sing. et al (1988)	24	y	24	HPLC	Radial Pak 150x3 9 5 µ	ACN/MeOH/ChCl3 (40·40 2) isocratic 0 5 ml/min	RT peak area		Hk
25 Mariath et al (1989)	25	y	36	OCC			absorbance		Rz
26 Abdel Kader (1991)	74	n	74	HPLC	Partisil 250x4 6 5 µ	ACN/THF/H2O isocratic 2 ml/min	peak height		Hk
27 Olmedilla et al (1993)	74	y	01 2	HPLC	Spheri-5 220x4 6 5 µ	ACN/CH2Cl2/MeOH (7 2:1) | ACN/MeOH (85.15) isocratic varying	RT/stop flow scan, co-chr. standard curve	Echinenone	Hc
28 Cano (1991)	28	n	78 1	HPLC	Hypersil 100x4 6 5 µ	MeOH/H2O (75 25), ethylacetate gradient 1 7 ml/min	HPLC, TLC, absorb , CR peak area		Hc
29 Almela et al (1991)	29	y	29	HPLC	Spherisorb 250x4 6 5 µ	PE/acetone gradient varying	RT/TLC standard curve		Hn
30 Micozzi et al (1990)	30	y	30	HPLC	Microsorb 250x4 6 5 µ	ACN/metylene-Cl/hexane|ACN/MeOH/Me-Cl/hexane combined varying	RT, absorb , CR peak area		Hk
31 Nagra et al (1988)	71 4		71.1	OCC			absorbance		Rz
32 Picha (1985)	32	n	32	Spectr			absorbance		O
33 Razungles et al (1989)	nf	n	33	HPLC	Brownlee 250x4 5 µ	acetone-H2O gradient 1 ml/min	peak		Hn
34. Takagi (1985)	34	y	34	HPLC	Hitachi 300x3	hexane bezene (1·1) | acetone gradient 0 6 ml/min	absorb peak area		Hn

SUMMARY OF METHODS USED FOR THE ANALYSIS OF CAROTENOIDS

Reference	Reference Ext	Sap	Chr	Method	Column Name/size Diam	Eluent composition/flow Type	Peak identification/ quantification	Internal standard	QM
35. Minguez-Mosquera et al. (1992)	39	1	? 35	HPLC	Spherisorb 250x4 5 μ	H2O/reagent/MeOH (1.1-8) | acetone/MeOH (1 1) gradient 2 ml/min	RT, absorb. peak area		Hk
36 Philip et al. (1988a)	36	n	36	HPLC	Waters resolve 150x3 9	MeOH-ethylacetate gradient 1 ml/min	absorb intern std	Sudan 1	Hk
37 Chen et al. (1992)	37	n	37	HPLC	Phenomenex 250x4 6 5 μ	ACN/MeOH/CHCl3/hexane (75 12 5 7 5 7 5) isocratic 1 ml/min	RT, TLC, co-chr. intern std.	β-apo 8 carotenal	Hb
38. Christophersen et al. (1989)	38	n	38	HPLC	Supelco 250x4.6 5 μ	MeOH-H2O/ethyl acetate (80.20) isocratic	RT, TLC peak area		Hk
39 Minguez-Mosquera et al (1990)	39	?	39	TLC	GF 254	PE/acetone/diethylamine (10:4:1)	absorb., color in UV absorbance		Rz
40 Wills et al. (1984)	72.1	n	72.1	OCC		acetone/PE (1-4%)	absorb absorbance		Rk
41 Benhura et al. (unpublished)	41	n	41	OCC		acetone/PE (4%)	absorbance		Rk
42. Khachik et al (1992)	42	n	42	HPLC	Microsorb 250x4 6 5 μ	ACN/MeOH/CH2Cl2/hexane combined varying	RT, MS, absorb., CR intern. std.	β-apo 8 carotenal/ate, nonapre	Hb
43 Rahman et al. (1990)	43	n	43	OCC	Brockman	PE	absorb		Rk
44 Daood et al. (1989)	44	y	44	HPLC	Chromasil 250x4.6 10 μ	ACN/MeOH/ethyl acetate (53 40-7) isocratic varying	TLC, absorb. not described		Hk
45. Homnava et al. (1990)	45	y	45	HPLC	Zorbax 250x4 6 5 μ	ACN/methylene-Cl/tri-ethylamine (350:150 1) isocratic 1 ml/min	RT peak area		Hk
46 Sian et al (1991)	71.2	n	46	Spectr.			absorbance		O
47. Huynh Hong et al (unpublished	71	?	71	HPLC/OCC					Hn
48 Adewusi et al. (in press)	48	n	01.1	HPLC	Spherisorb 250x4.6 5 μ	isocratic 1.5 ml/min	RT peak area		Hk
49. Almeida et al (1988)	67	y	67.1	OCC		acetone/PE (3%)	absorb , CR absorbance		Rk
50 Deli et al (1992)	50	y	50	HPLC	Chromasil 250x4.6 6 μ	MeOH-H2O(12%)/MeOH/acetone(50%)-MeOH gradient 1.5 ml/min	RT, MS, absorb. peak height	cantaxanthin	Hk
51. Daood et al (1992)	44	y	44.1	HPLC	Chromasil	ACN/2-isopropanol/H2) (39:57:4) isocratic 1 ml/min	TLC, absorb., CR peak		Hn

SUMMARY OF METHODS USED FOR THE ANALYSIS OF CAROTENOIDS

Reference	Reference Ext	Sap	Chr	Method	Column Name/size Diam	Eluent composition/flow Type	Peak identification/ quantification	Internal standard	QM
52 Dikshit et al. (1988)	52	y	52	HPLC	Micropak 300x4 10 µ	ACN/MeOH (80 20) isocratic 1 2 ml/min	RT peak area		Hk
53 Gregory et al (1987)	53	y	53	HPLC	Waters resolve 150x3 9	MeOH/ethyl acetate (linear) gradient 1 8 ml/min	RT, TLC, absorb CR intern. std.	cantaxanthin, capsanthin	Hc
54 Godoy et al. (submitted)	67	n	67 4	OCC		PE/ethylether(5%)-PE/acetone(10%)-PE	TLC, absorb., CR absorbance		Rk
55 Wills et al. (1986A)	72.1	n	72 1	OCC		acetone/PE (1-4%)	absorb. absorbance		Rk
56 Wills et al (1986B)	72 1	n	72 1	OCC		acetone/PE (1-4%)	absorb absorbance		Rk
57 Wills et al. (1986C)	72 1	n	72.1	OCC		acetone/PE (1-4%)	absorb absorbance		Rk
58. Wills et al (1987A)	72.1	n	72 1	OCC		acetone/PE (1-4%)	absorb absorbance		Rk
59. Wills et al (1987B)	72 1	n	72.1	OCC		acetone/PE (1-4%)	absorb. absorbance		Rk
60. Wills et al (1983)	72.1	n	72 1	OCC		acetone/PE (1-4%)	absorb absorbance		Rk
61 Wilberg et al. (paper, 1993)	61		61	HPLC	Waters		RT, spiking, TLC, absorb., CR peak area		Hn
62 Kim et al (1990)	62	y	62	HPLC	Zorbax 250x4 6 7 µ	ACN CH2Cl2.MeOH (7:2:1) isocratic	absorb peak area		Hk
63. Mejia et al. (1988)	74 3	n	75	HPLC	Novapak 150x3 9 4 µ	acetone/MeOH/THF (58:38:7) isocratic 1 ml/min	RT/literature peak height		Hk
64 Mercadante et al. (1991)	67	n	67 8	OCC		acetone in PE	TLC, absorb , CR absorbance		Rk
65. Philip et al (1988B)	36	n	36	HPLC	Waters resolve 150x3 9	MeOH-ethylacetate gradient 1 ml/min	absorb. intern. std.	Sudan 1	Hk
66. Moorthy et al. (1990)	71	n	71	OCC		acetone/hexane isocratic	absorb absorbance		Rk
67. Rodriguez et al (1976)	67	y	67	OCC		acetone/ethyl ether	TLC, absorb., co-chr. absorbance		Rk
68. Rouseff (1992)	68	n	68	HPLC	Analytichem 250x4 6	ACN/CH2Cl2/MeOH (65.25.10) isocratic 1 ml/min	RT, absorb., literature peak area		Hk

SUMMARY OF METHODS USED FOR THE ANALYSIS OF CAROTENOIDS

Reference	Reference Ext	Sap	Chr	Method	Column Name/size	Diam	Eluent composition/flow Type	Peak identification/ quantification	Internal standard	QM
69 Tavares et al (submitted)	67	n	67.9	OCC			acetone-PE | H2O-acetone | ether-PE	TLC, absorb., CR absorbance		Rk
70. Ershow et al. (1990)	70	?	70	OCC						Rn
71. AOAC (1984)	71	n/y	71	OCC			acetone/hexane isocratic	absorbance		Fk
72 Gebhardt et al (1977)	72	n	72	OCC			acetone/PE (1-3%)	absorbance		Rk
73 Speek et al. (1986)	73	y	73	HPLC	Hypersil 250x4 6	3 µ	MeOH/CH3CN/CHCl3/H2O (200:250:90·11) isocratic 1 5 ml/min	RT peak height		Hc
74 Bushway et al. (1982)	74	n	74	HPLC	Partisil 250x4.6	5 µ	ACN/THF/H2O (85 12 5 2.5) isocratic 2 ml/min	RT, TLC, absorb. peak height		Hb
75 Bushway (1985)	7/ 1	n	75	HPLC	Novapak 150x3 9	4 µ	acetone/MeOH/THF (58.38 7) isocratic 1 ml/min	RT, absorb peak height		Hc
76 Thompson et al (1985)	76	y	76	HPLC	Spheri-5 250x4.6	5 µ	ACM/MeOH/H2O | ACN/MeOh/butan-1-ol gradient 2 ml/min	RT, chrom behav peak area		Hk
77 Holland et al (1991)	77	y	67	HPLC	Zorbax	5 µ	ACN/CH2Cl2/MeOH (7:2:1) isocratic 1 3 ml/min	absorb absorbance		Hk
78 Schwartz et al (1981)	78		78	HPLC						Hn
79 Reddy et al (1993)	79	y		HPLC	Shimadzu 250x4 6	5 µ	ACN/CH2Cl2/MeOH (7 2 1) isocratic			Hn
80 Vaidya et al. (1993)	80		80	HPLC				RT peak area/height		Hn
81 Nezam et al (1991)	81		81	Spectr.				absorbance		O
82 Saleh et al (1977)	71		71	OCC						Rn
83 Cravioto et al (1942)	83		83	unknown						C
84 Skurjkhin (1993)	84		84	unknown						-
85. Kaic-Rak (1993)	85	y	85	OCC	Spidex					Rn

SUMMARY OF METHODS USED FOR THE ANALYSIS OF CAROTENOIDS

Reference	Reference Ext	Sap	Chr	Method	Column Name/size Diam	Eluent composition/flow Type	Peak identification/ quantification	Internal standard	QM
86 VITAL (1993)	86		86	HPLC					hn
87 Burlingame (1993)	87		87	HPLC					Hn
88 Strniska et al (1969)	88	n	88	OCC			absorb absorb.		Rz
89 Hidaka et al (1987)	89	y	89	OCC		acetone in hexane (5%-10%)	absorbance		Rk
90 Wolde-Gebriel (1993)	90		90	Spectr.			absorbance		O
91 Vollebregt et al (1993)	91	y	91	HPLC	Hypersil 125x4 6 3 µ	ACN/MeOH/CH2Cl2/H2O (700·150 100·25) isocratic 1 ml/min	RT peak height		Hc
92 McDowell et al (1983)	92		92	HPLC	Bondapak 10 µ	CCl4/MeOH (90 10) isocratic 1.5 ml/min	RT peak area		Rk
93 Philip et al (1988)	93		93	HPLC	Waters resolve 150x3 9	MeOH-ethyl acetate gradient 1 ml/min	Rt, TLC, CR peak area	Sudan I	Hk
94 Kajadphai (1993)	94	n	94	HPLC	Novapak 150x3 9 5 µ	MeOH/ACN (7 3) isocratic 2 ml/min	RT, co-chr., peak area	β-apo 8 carotenal	Hc
95. Kapeller (1980)	95		95	Fluor.					O
96 Lewis J. (1993)	96		96	HPLC					Hn

5. LOCAL NAMES OF FOODS

English name	Local name
China (based on food consumed in Australia)	
Angled luffa	Sze gwa
Bean	Ah choi
Bitter melon	Foo gwa
Chinese cabbage	Wong-baak
Chinese chives	Gau choi
Chinese flowering cabbage	Choi sum
Chinese spinach	Een choi
Chinese white cabbage	Baak choi
Garland chrysanthemum	Tong ho
Hairy melon	Tseet gwa
Mustard cabbage	Gaai choi
Water spinach	Ong choi
Watercress	Sai yeung choi
Wax gourd	Dong gwa
Yard-long bean	Dau gok
Brazil	
Tree tomato	Mineiro tomato
Egypt	
Cabbage	Koromb malfuf
Cauliflower	Quarnabit
Celery	Karafs
Chard	Salq
Chicory	Chicoria
Grapefruit	Lymon Hindi
Leek	Kurrat
Lemon	Assir limon
Onion	Bassal Akhdar
Orange	Burtukal
Pepper, hot	Fulful Hâr
Pepper, sweet	Fulful heiou
Squash	Kûsa
Turnip	Lift
Guatemala	
Amaranth	Bledo
Apazote	Apazote
Beet	Hojas de remolacha
Bell tree dahlia	Txoloj
Carrot	Zanahoria
Chard, Swiss	Acelga
Chayote	Puntas de guisquil
Chipilin	Chipilin
Chives	Cebollin
Chomtee	Chomtee
Coriander	Culantro
Cowpea	Frijol
Fernaldia	Loroco
Lettuce	Lechuga
Malabar gourd	Ayote

English name	Local name
Malanga	Osh
Mint	Yerba buena
Nightshade	Macuy
Parsley	Perejil
Purslane	Verdolaga
Radish	Hoja de rabano
Spinach	Espinaca
Sweet potato	Camote
Turnip	Hojas de nabo
Watercress	Berro
Wax beans	Hojas de frijol
Indonesia	
Amaranth	Bayam
Cassava	Singkong, daun
Chinese cabbage	Caisin
French beans	Buncis
Goa beans	Kecipir
Indian mulberry	Mengkudu, daun
Maize	Jagung
Papaya	Pepaya, daun
Sauropus	Katuk, daun
Swamp cabbage	Kangkung
Sweet potato, orange	Ubi jalar merah
Sweet potato, white	Ubi jalar putih
Taro	Talas, daun
Yardlong bean	Kacang panjang

English name	Local name
Malaysia	
Plum, red	Buah plum
Banana	Pisang tanduk
Carrot	Lobak merah
Cashew leaves	Pucuk
Ceylon spinach	Remayong
Chili pepper, green	Lada hijau
Chili, red	Lada merah
Chinese cabbage	Pak-coy
Chinese chives	K cai
Chinese kale	Kai-lan-coy
Chinese mustard leaves	Sawi
Coriander leaves	Daun ketumbar
Curry leaves	Karrupillay
Daun kelor	Cekur manis
Drumstick leaves	Daun kel
Fern shoots	Pucuk paku
Four-angled bean	Kacang botor
French bean	Kacang buncis
Jackfruit	Nangka
Lettuce	Sang-coy
Long bean	Kacang panjang
Mandarin orange	Limau Cina
Mango, black-gold	Mangga
Mint leaves	Daun pudina
Musk lime	Limau kesturi
Orange	Limau manis
Papaya	Betik

English name	Local name
Papaya shoots	Daun beti
Paprika, Bell pepper	Lada hijau besar
Pegaga gajah	Pegaga gajah
Pumpkin	Labu merah
Salted vegetables	Hum-coy
Sesbania	Daun turi
Snake gourd	Ketola ular
Spinach	Bayani putih
Spring onion	Daun bawang
Starfruit	Belimbing manis
Swamp cabbage	Kangkung
Tapioca shoots	Pucuk ubi kayu
Terung pipit	Terung pipit
Tree tomato	Tomato opkok
Watermelon, red	Tembikai
Wolfberry leaves	Kau-kei-coy
Yam stalks	Batang keladi
<u>Nepal</u>	
Amaranth	Latte saag
Asparagus shoots	Kurilo
Bitter gourd	Tite Karela
Brinjal	Bhanta/Bhindi
Buckweat leaves	Fafar ko saag
Cabbage	Bandakobi
Carrot	Gazer
Cauliflower	Cauli
Chilli, green	Hariyo Khursani

English name	Local name
Chilli, red	Rato Khursani
Cho-cho marrow	Squash
Curli doek	Halhale saag
Fern shoots	Neuro
Garden cress	Chamsur
Indian spinach	Poi saag kavro
Ladies finger	Ramtoriya
Lamb's quarter	Bethe saag
Lettuce	Jiri saag
Mint	Pudina
Mustard leaves	Tori saag
Pigwid	Lunde
Pigwig	Ban lunde
Prostrate	Bhangiraj
Pumpkin	Pakeko Fursi
Pumpkin leaves	Pharsi munta
Pumpkin, green	Hariyo Fursi
Rape leaves	Rayo saag
Rape shoots, tender	Duku saag
Spinach	Palung
Stinging nettle	Sisnoo
Sweet potato	Sakharkand
Tomato	Tamatar
Turnip	Salgum
Water cress	Sim rayo
Yarba-de-tega	Piro ghanse

English name	Local name
Vietnam	
Amaranth, red	Rau den dò
Amaranth, white	Rau den trang
Apricot	Mo
Ashgourd squash	Bí dao
Avocado	Quà bo
Balm-mint	Tía tô
Beans, black	Dâu den
Carrot	Cà Rot
Chili	Ot dò
Chinese apple	Táo tây
Chinese cabbage	Cài trang
Chinese celery	Can tây
Chrysanthemum	Cài cúc
Coriander	Rau mùi
Cowpea	Dâu dua
Dill	Thìa là
Dismanthus	Rau rút
Herbaceous plant (edible)	Xuong sòng
Jackfruit	Mít
Jute (potherbs)	Rau day
Kidney bean	Dâu cô ve
Kohlrabi	Su hào
Leek	Tòi tây
Lettuce	Xà lách
Lily flower	Hoa ly
Maize	Ngô vàng
Mango	Dùa

English name	Local name
Mint leaves	Rau húng
Mint	Rau thom
Momordica	Gac
Momordica oil	Dau gac
Mung bean, green	Dâu xanh
Onion fragant	He là
Orange, bohah	Cam bo ha
Orange, vinh	Cam vinh
Papaya	Du du chín
Persimmon, kaki	Hong chín
Pineapple	Dúa
Potato leaves	Rau lang
Pumpkin leaves	Rau bí
Pumpkin/squash	Bí dò (ngô)
Rape	Rau cài xanh
Sauropus	Rau ngót
Soybean	Dâu tuong
Sponge gourd	Muóp
Spring onion	Hành lá
Sweet majoram	Kinh giới
Sweet potato, pale	Khoai lang trang
Sweet potato, yellow	Khoai lang nghê
Thyme	Rau ram (persicaria)
Tomato	Cà chua
Water dropwort	Can ta
Water spinach	Rau muông
Watercress	Cài soong
Watermelon	Dua hau

6. DISCUSSION AND RECOMMENDATIONS

Data available on the carotenoid content of foods

Most of the data collected so far comes from Asia (Bangladesh, China, India, Indonesia, Japan, Malaysia, Nepal, Pakistan, Taiwan, Thailand and Vietnam). Latin-America (Brazil, Chile, Guatemala and Mexico), Australasia (Australia and New Zealand), Europe (Croatia, Finland, Hungary, the Netherlands, Russian Federation, Spain and the United Kingdom) and North America (Canada and the United States). In general, there is little information on the carotenoid composition of African foods although there is some data from Egypt, Ethiopia, Ghana and Zimbabwe Thus, there is an urgent need to generate data on the carotenoid content of African foods and a continuing need for such data for Asia, Latin America and Eastern Europe. In addition, there is practically no data on the carotenoid composition of prepared foods in developing countries.

The best way to do this would be to establish a network of regional centres for analyzing foods with particular attention being paid to the analysis of carotenoids. From the following list, a start could be made with two centres in Africa and one in each of the other regions.

* Africa
    * Ethiopia
    * Anglophone West Africa; for example, Nigeria or Ghana
    * Eastern and Southern Africa; for example, Tanzania or Zimbabwe
    * Francophone West Africa; for example, Senegal
    * North Africa. for example, Egypt

* Asia
    * Indonesia
    * India
    * The Philippines

* Latin America
    * Brazil
    * Mexico
    * Guatemala

* Eastern Europe and newly emerging nations
    * Poland or Hungary
    * Kazakhstan

Such centres could act as training and reference centres for nearby countries. They would need to be supported by established centres in industrialized countries which could assist with training, quality control, and the development and testing of appropriate methods. An appropriate organizational structure will need to be established and the necessary funds obtained.

Data quality and methods used

Data originating from developing countries were generally not determined by HPLC and this explains why much of these data were not up to CAREX standards Furthermore, the CAREX confidence codes are also determined by the number of acceptable values for a given food As most of the foods in the database are not aggregated to any extent, it is to be expected that the data quality will be low according to these standards.

In addition, the CAREX system does require that there is sufficient documentation to allow data to be evaluated properly. Thus estimates given in this report of data quality for many foods from developing countries are possibly lower than that appropriate to the data. Often, reference to the source of data was missing or impossible to locate Most of the data of high quality comes from few laboratories

The proportions of data of various quality are presented in Table 6 1. Although the best method for determining the individual carotenoid content of foods is by using HPLC, open-column chromatography can give accurate estimates of the provitamin A content of foods, provided that other aspects of the method are adequate and that the procedures are well documented Good agreement between HPLC and OCC values as, for example in Carvalho et al. (20), attest to the reliability of this method. However, there is a need to establish criteria for better evaluating data obtained by open-column chromatography.

Table 6.1 Distribution of data according to method and quality

Rating	Method	
	HPLC	OCC
a	-	-
b	45 (2.3%)	-
c	269 (14.0%)	6 (0.3%)
k	321 (16.7%)	374 (19.5%)
n	487 (25.3%)	201 (10.5%)
z	-	50 (2.6%)
Other methods	49 (2.5%)	
Unknown methods	120 (6.2%)	

(For description of ratings, see Section 2: Data evaluation)

The data found in national food composition tables are generally higher than those presented in Chapter 3 For example as shown in Table 6 2, the data on the provitamin A content of foods consumed in a recent study of pregnant women in Indonesia (D. Suharno, C.E West, Muhilal D. Karyadi, J.G A J. Hautvast, in preparation) are high compared with what could be regarded as the most appropriate estimates. Thus revision of the data on the (pro)vitamin A content of foods has resulted in at least a 50% reduction in the estimated intake of vitamin A.

Table 6.2 Comparison of provitamin A content of foods as listed in Indonesian food composition tables and current table

Name			Provitamin A content RE/100 g edible portion	
English	Indonesian	Scientific	Indonesian tables	Revised data
Fruits				
Avocado	Apokat	Persea americana	34[a,b]	7[d]
Banana	Pisang	Musa sapientum	90[a]	12[d]
Bottlegourd, fruit	Labu siam	Lagenaria leucantha	3[a]	2[e]
Gourd, fruit	Gambas	Luffa acutangula	57[b]	15[e]
Jack fruit, unripe	Nangka muda	Artocarpus heterophyllus	3[a,b]	0[f]
Jack fruit, ripe	Nangka	Artocarpus heterophyllus	50[a,b]	10[d]
Orange	Jeruk	Citrus nobilis	65[a]	8[d]
Papaya, fruit, ripe	Papaya	Carica papaya	55[a,b]	201[e]
Water melon	Semangka	Citrullus vulgaris	91[a,c]	55[d]
Vegetables				
Carrot	Wortel	Daucus carota	1800[a,b]	1000[d]
Chili, red	Cabai merah	Capsicum annuum	810[c]	150[d]
Cassava, leaves	Daun singkong	Manihot utilissima	1650[a,b]	1054[g]

Table 6.2 (continued)

Name			Provitamin A content RE/100 g edible portion	
English	Indonesian	Scientific	Indonesian tables	Revised data
Chinese cabbage	Petsai	Brassica chinenses	499[a]	300[d]
Egg plant	Terong	Solanum melongena	6[c]	10[d]
Garlic	Bawang putih	Allium sativum	0[a,c]	10[d]
Jointfir spinach	Daun melinjo	Gnetum gemon	1500[a]	608[g]
Locust bean	Petai	Parkia speciosa	30[b]	121[g]
Maize	Jagung	Zea mays	65[c]	42[g]
Mungbean, bean	Kacang hijau	Vigna radiata	59[c]	0[h]
Mungbean, sprouts	Kecambah	Vigna radiata	3[b]	5[i]
Papaya, leaves	Daun pepaya	Carica papaya	2738[b]	1261[g]
Sauropus	Katuk	Sauropus androgenus	1555[a,b]	1300[g]
Spinach	Bayam	Amaranthus viridis	914[a,b]	207[g]
Sweet potato, yellow	Ubi jalar	Ipomoea batatas	302[c]	133[g]
Tomato	Tomat	Lycopersicum escuientum	255[a,b]	60[d]

Table 6.2 (continued)

Name			Provitamin A content RE/100 g edible portion	
English	Indonesian	Scientific	Indonesian tables	Revised data
Water spinach	Kangkung	Ipomoea aquatica	945[a,b]	214[g]
White cabbage	Kobis	Brassica oleracea	10[a]	13[j]
Yard long bean	Kacang panjang	Vigna unguiculata	50[a,b]	24[g]

a, reference 101; b, reference 102, c, reference 103; d, compiled from Chapter 3; e, D H Calloway, personal communication, f, reference 3, g, reference 86, h, reference 9, i, reference 70, j, reference 97.

Many of the problems encountered would have been overcome if appropriate guidelines for the production of data of adequate quality had been followed and adequately described Achieving adequate data quality is not an unattainable goal but of obtaining data of a quality sufficient for the purpose to which data will be put Fortunately, a book has recently been published which could readily act as a handbook for those generating and reporting data on food composition The book (98), written by Dr Heather Greenfield and Professor David Southgate, should be consulted by all people involved in such work as it addresses the issue involved It will be used as the basis for the International Postgraduate Courses on the Production and Use of Food Composition Data in Nutrition, the second of which will be held in Wageningen, 3-21 October 1994. People involved in generating and compiling data on the carotenoid content of foods analysis would benefit from attending such a course

In addition, there is a need for more training on the specific aspects of carotenoid analysis An initial training could be provided in courses, which could be held in an industrialized country, but such training would need to be followed up by on-site training and back-up over a period of years Such training would assume that manpower, facilities and funds would be available for the analytical work to be carried out

The specific problems encountered when examining the data included the following.

* Identification of foods Sometimes, the scientific name was used to identify the appropriate English common name When no English name could be found, the literal local name was transformed into English The extent of descriptive

information provided in the original publications varied greatly among the food items.

* Sampling In general, procedures used for sampling of foods were described inadequately Information on the origin and number of samples is vital for assessing the quality of data

* Time between sampling and analysis Generally, this was not reported in publications Ideally, foods should be analyzed directly after sampling, preferably on the same day. If this is not possible, fod samples should be stored appropriately

* Saponification steps· Usually, the procedures followed were adequately described. However more data on the carotenoid content of foods obtained using methods with and without saponification are required.

* Exposure to light and air· Descriptions of preliminary sample treatment often do not indicate whether steps were taken to reduce such exposure. These are necessary in order to minimize oxidation and isomerization of the carotenoids.

* Analytical methods used The principle method used in Latin-America and some of the Asian countries was open-column chromatography (OCC). In general, investigators using OCC
    * usually provided information on the concentration of the standard solutions but only limited detail on the purity of the standard materials used, and
    * usually restrict information on the identification of the carotenoids to retention time and absorption

  Thus investigators using OCC should provide sufficient detail to enable the quality of the data produced to be evaluated.

* Quality control procedures for HPLC. External standards, reference materials and validation methods have often not been used by investigators carrying out analyses by HPLC The general reluctance to use internal standards, even though some are now commercially available, can be seen from the data presented in Chapter 4 The use of internal standards such as ß-apo-8'-carotenal, ethyl ß-apo-8'-carotenoate and nonapreno-ß-carotene is essential when using HPLC because of possible losses especially during the extraction procedure.

Recommendations for action

In order to overcome the general lack of data of sufficient quality, a series of recommendations are made Funds are required urgently for this work in order to assist in the fight to eradicate vitamin A deficiency before the end of the millennium

1. Use of guidelines Those involved in generating and compiling data should follow the guidelines set down by Greenfield and Southgate (98) and aim, whenever possible, to produce data which we have classed as Ha or Oa A description of the method used in generating and selecting the data should always be given Special attention should also be given to sampling procedures, the use of standard reference materials of established purity, description of methods used to identify individual carotenoids, and recoveries.

2. Establishment of regional centres A series of regional centres should be established Initially, there should be two in Africa and one each in Asia, Latin America and Eastern Europe/former countries of the Soviet Union These centres would analyze foods and act as reference and training centres for the region Special attention should be given to the analysis of carotenoids in indigenous foods

3. Support centres in industrialized countries. In order to support the regional centres, two back-up cen res should be established in industrialized countries which could assist with training, quality control, and the development and testing of appropriate methods Such centres could also assist in the collection, evaluation and dissemination of data on the carotenoid content of foods

4. Training aimed at understanding the problems of generating and using food composition data An example of such a training programme is the biennial International Postgraduate Course on the Production and Use of Food Composition Data in Nutrition which is held in Wageningen The second course will be held in October 1994 and the third is being planned for October 1996 This course will probably remain the major international training activity on this subject and could be used for the training of facilitators for regional courses

5. Training on specific aspects of carotenoid analysis Analysis of carotenoids in foods is a specialized subject and requires specific training Such training could be provided initially in courses in an industrialized country, but would need to be backed up by on-site training and help from an external institution over a period of years On-site training would result in a programme more applicable to local conditions and also allow simultaneous training of several analysts

6. Development and evaluation of non-HPLC methods for determining carotenoids in foods The use of HPLC is often difficult in developing countries for a number of reasons including the initial cost of purchasing the equipment, the cost and availability of supplies, adverse climatic conditions, and unreliable and fluctuating electric power supplies Thus non-HPLC methods, such as open-column chromatography, should be developed and promoted Methods of evaluating data from such methods, analogous to the CAREX system, should also be developed

7. Standard reference materials: There is a need for the ready supply of standard reference materials for carotenoids in foods. Both the United States National Institute of Science and Technology (NIST) and the Community Bureau of Reference of the Commission of the European Union (BCR) are active in the area of standard reference materials but none are yet available for carotenoids. Therefore standard reference materials should be established, maintained and made available at an affordable price to recognized institutions In addition, training should be provided in the use of standard reference materials and of in-house materials with values linked to those of certified standard reference materials.

8. Collaborative inter-laboratory studies: Such studies should be carried out in order to evaluate laboratory performance and to stimulate its improvement.

9. Bioavailability In addition to improving information on the carotenoid content of foods, more work needs to be done on the bioavailability of carotenoids in order to understand the possible contribution of carotenoids to improving (pro)vitamin A status The role of the amount and type of fat in the diet, the nature and extent of intestinal parasitaemia, the effect of the matrix in which the carotenoids are consumed, and the role of other constituents in the diet (e.g. pectin), are poorly understood. In addition, a series of indices to take into account the bioavailability of carotenoids, should be developed

7. REFERENCES

1. Granado F, Olmedilla B, Blanco I, Rojas-Hidalgo E Carotenoid composition in raw and cooked Spanish vegetables. J Agric Food Chem 1992,40·2135-40

2 López-Palacios CY, Bulux J, Schwartz S, Solomons NW Determination of vitamin A activity of selected Guatemalan vegetables. Bulletin of Research Abstracts of the National Committee for the Blind and Deaf of Guatemala 1993;4 9

3. Sungpuag P Development of database for vitamin A and ß-carotene in Thai foods and establishment of simplified dietary assessment of retinol equivalent consumption. Mahidol, Mahidol University, 1988

4 Booth S, Bressani R, Johns T Nutrient content of selected indigenous leafy vegetables consumed by the Kechi people of Alta Verapaz, Guatemala J Food Comp Anal 1992,5 25-34

5. Kuhnlein HV Nutrient values in indigenous wild plant greens and roots used by the Nuxalk people of Bella Coola, British Columbia J Food Comp Anal 1990,3 38-46

6. Tee E-S, Lim C-L Carotenoid composition and content of Malaysian vegetables and fruits by the AOAC and HPLC methods Food Chem 1991,41 309-39

7. Tee E-S, Lim C-L Re-analysis of vitamin A values of selected Malaysian foods of animal origin by the AOAC and HPLC methods. Food Chem 1992,45.289-96

8 Tee E-S, Lim C-L Analysis of carotenoids in vegetables by HPLC Asean Food J 1992;7 91-9

9 Tsou SCS Provitamin A content of AVRDC vegetable crops, 1993 (unpublished).

10. Mercadante AZ, Rodriguez-Amaya DB Carotenoid composition and vitamin A value of some native Brazilian green leafy vegetables Int J Food Sci Technol 1990,25 213-9.

11. Cavalcante ML, Rodriguez-Amaya DB Carotenoid composition of the tropical fruits *Eugenia uniflora* and *Malpighia Glabra* In Charalambous G, editor Food Science and Human Nutrition Amsterdam Elsevier, 1992 643-50

12. Godoy HT, Rodriguez-Amaya DB Confirmation of the structure of papaya ß-cryptoxanthin monoepoxide Food Chem 1990,36 281-6

13 Rodriguez-Amaya DB, Bobbio PA, Bobbio FO Carotenoid composition and vitamin A value of the Brasilian fruit *Cyphomandra betacea* Food Chem 1983,12 61-5

14 Rodriguez-Amaya DB, Tavares CA Importance of *cis*-isomer separation in determining provitamin A in tomato and tomato products Food Chem 1992,45.297-302.

15. Holland B, Unwin ID, Buss DH. First supplement to the McCance & Widdowson's The composition of foods, 5th edition Fruits and nuts Cambridge Royal Society of Chemistry, 1992

16. Kimura M, Rodriguez-Amaya DB, Yokoyama SM Cultivar differences and geographic effects on the carotenoid composition and vitamin A value of Papaya. Lebensm Wiss Technol 1991,24.415-8

17. Kimura M, Rodriguez-Amaya DB, Godoy HT. Assessment of the saponification step in the quantitative determination of carotenoids and provitamins A Food Chem 1990;35·187-95

18. VITAL Carotenoid content of sun dried and solar dried foods (unpublished)

19 Arima HK, Rodriguez-Amaya DB Carotenoid composition and vitamin A value of a squash and a pumpkin from northeastern Brazil Arch Latinoamer Nutr 1990;40·284-292.

20. Carvalho PRN, Collins CH, Rodriguez Amaya DB. Comparison of provitamin A determination by normal-phase gravity-flow column chromatography and reversed-phase high performance liquid chromatography Chromatographia 1992,33 133-7

21. Edwards CG, Lee CY. Measurement of provitamin A carotenoids in fresh and canned carrots and green peas J Food Science 1986,51 534-5

22. Arima HK, Rodriguez-Amaya DB Carotenoid composition and vitamin A value of commercial Brazilian squashes and pumpkins J Micronutr Anal 1988;4·177-91.

23. Trujillo-Quijano JA, Rodriguez-Amaya DB, Esteves W, Plonis GF. Carotenoid composition and vitamin A values of oils from four Brazilian palm fruits. Fat Sci Technol 1990,6:222-6

24. Singh U, Bradbury JH HPLC determination of vitamin A and vitamin D_2 in South Pacific root crops. J Sci Food Agric 1988;45.87-94

25. Mariath JGR, Lima MCC, Santos LMP. Vitamin A activity of buriti (*Mauritia vinifera* Mart) and its effectiveness in the treatment and prevention of xerophthalmia. Am J Clin Nutr 1989,49 849-53

26. Abdel-Kader ZM Determination of carotenoids in foods with high-performance liquid chromatography Die Nahrung 1991,35.689-93

27. Olmedilla B, Granado F, Blanco I, Rojas-Hidalgo E Quantitation of provitamin A and non-provitamin A carotenoids in the fruits most commonly consumed in Spain. In. Food and Cancer Prevention. Chemical and Biological Aspects Waldron KW, Johnson IT, Fenwick GR (eds). Cambridge Royal Society of Chemistry, 1993,141-5

28. Cano MP HPLC Separation of chlorophyll and carotenoid pigments of four kiwi fruit cultivars. J Agric Food Chem 1991;39·1786-91.

29. Almela L, López-Roca JM, Candela ME, Alcázar MD Carotenoid composition of new cultivars of red pepper for paprika J Agric Food Chem 1991,39 1606-9

30. Micozzi MS, Beecher GR, Taylor PR, Khachik F Carotenoid analyses of selected raw and cooked foods associated with a lower risk for cancer J Natl Cancer Inst 1990,82.282-5

31 Nagra SA, Khan S Vitamin A (ß-carotene) losses in Pakistani cooking J Sci Food Agric 1988,46 249-51

32. Picha DH Crude protein, minerals, and total carotenoids in sweet potatoes. J Food Science 1985,50.1768-9

33 Razungles A, Oszmianski J, Sapis J-C Determination of carotenoids in fruits of *Rosa sp (Rosa canina* and *Rosa rugosa)* and of chokeberry *(Aronia melanocarpa)*. J Food Science 1989,54 774-5

34 Takagi S Determination of green leaf carotenoids by HPLC Agric Biol Chem 1985,49.1211-3

35 Mínguez-Mosquera MI, Gandul-Rojas B, Gallardo-Guerro ML Rapid method of quantification of chlorophylls and carotenoids in virgin olive oil by high-performance liquid chromatography J Agric Food Chem 1992,40 60-3

36 Philip T, Chen T-S Development of a method for the quantitative estimation of provitamin A carotenoids in some fruits J Food Science 1988,53:1703-6.

37 Chen BH, Chen YY Determination of carotenoids and chlorophylls in water convolvulus (*Ipomoea aquatica*) by liquid chromatography Food Chem 1992;45 129-34.

38. Christophersen AG, Knuthsen P, Skibsted LH Determination of carotenoids in salmonoids Z Lebensm Unters Forsch 1989 188 413-8

39. Mínguez Mosquera MI, Garrido-Fernández J, Gandul-Rojas B Quantification of pigments in fermented Manzanilla and Hojiblanca olives J Agric Food Chem 1990,38 1662-6.

40. Wills RBH, Wong AWK, Scriven FM, Greenfield H Nutrient composition of Chinese vegetables J Agric Food Chem 1984,32 413-6

41. Benhura MAN, Chitsiku IC. Effects of cooking, drying and storage on the ß-carotene content of Guku (*Bidens pilosa*) leaves (unpublished)

42. Khachik F, Goli MB, Beecher G, Holden J, Lusby WR, Tenorio MD, Barrera MR. Effect of food preparation on qualitative and quantitative distribution of major carotenoids of tomatoes and several green vegetables J Agric Food Chem 1992;40.390-8.

43. Rahman MM, Wahed MA, Ali MA ß-Carotene losses during different methods of cooking green leafy vegetables in Bangladesh J Food Comp Anal 1990,3 47-53

44. Daood HG, Czinkotai B, Hoschke Á, Biacs P. High-performance liquid chromatography of chlorophylls and carotenoids from vegetables. J Chrom 1989;472:296-302.

45. Homnava A, Rogers W, Eitenmiller RR. Provitamin A activity of specialty fruit marketed in the United States. J Food Comp Anal 1990;3·119-33.

46. Sian NK, Ishak S Carotenoid and anthocyanin contents of papaya and pineapple: influence of blanching and predrying treatments. Food Chem 1991;39·175-85

47 Huynh Hong Nga, Le Huyen Duong Total carotenoid and ß-carotene contents of vegetables and fruits in Vietnam (unpublished)

48. Adewusi SRA, Bradbury JH Carotenoids in cassava comparison of an open column and HPLC methods of analysis J Sci Food Agric. (in press).

49 Almeida LB, Penteado MVC Carotenoids and pro-vitamin A value of white fleshed Brazilian sweet potatoes (*Ipomoea batatas* Lam.) J Food Comp Anal 1988;1:341-52.

50. Deli J, Matus Z, Szabolcs J. Carotenoid composition in the fruits of black paprika (*Capsicum annuum* variety *longum nigrum*) during ripening. J Agric Food Chem 1992;40.2072-6.

51. Daood HG, Biacs P, Czinkotai B, Hoschke Á Chromatographic investigation of carotenoids, sugars and organic acids from *Diospyros kaki* fruits. Food Chem 1992;45:151-5.

52. Dikshit SN, Udipi SA. Separation of carotenoids and estimation of beta-carotene content of selected Indian foods and food preparations by HPLC. J Food Sci Technol 1988;25:39-41.

53. Gregory GK, Chen T-S, Philip T. Quantitative analysis of carotenoids and carotenoid esters in fruits by HPLC. red bell peppers J Food Science 1987;52·1071-3.

54. Godoy HT, Rodriguez-Amaya DB Occurence of *cis*-isomers of provitamins A in Brazilian fruits. J Agric Food Chem (submitted).

55. Wills RBH, El-Ghetany Y Composition of Australian foods. 30. Apples and pears. Food Technol Aust 1986;38.77-82.

56. Wills RBH, Lim JSK, Greenfield H Composition of Australian foods. 31. Tropical and sub-tropical fruit. Food Technol Aust 1986,38·118-23.

57. Wills RBH, Lim JSK, Greenfield H. Composition of Australian foods. 32. Leafy, stem and other vegetables. Food Technol Aust 1986;38·416-417, 421.

58. Wills RBH, Lim JSK, Greenfield H. Composition of Australian foods. 38. Tuber, root and bulb vegetables. Food Technol Aust 1987,39.384-6.

59. Wills RBH, Lim JSK, Greenfield H Composition of Australian foods 39 Vegetable fruits. Food Technol Aust 1987,39 488-91

60. Wills RBH, Scriven FM, Greenfield H Nutrient composition of stone fruit (*Prunus* spp.) cultivars apricot, cherry, nectarine, peach and plum. J Sci Food Agric 1983,34:1383-9.

61. Wilberg VC, Rodriguez-Amaya DB HPLC quantitation of major carotenoids of fresh and processed guava, mango and papaya (paper presented at 10th International Symposium on Carotenoids, Trondheim, 20-25 June 1993)

62. Kim Y, English C, Reich P, Gerber LE, Simpson KL. Vitamin A and carotenoids in human milk. J Agric Food Chem 1990,38·1930-3

63. Mejía LA, Hudson E, Gonzalez de Mejía E, Vazques F Carotenoid content and vitamin A activity of some common cultivars of Mexican peppers (*Capsicum annuum*) as determined by HPLC J Food Science 1988,53 1448-51.

64. Mercadante AZ, Rodriguez-Amaya DB Carotenoid composition of a leafy vegetable in relation to some agricultural variables J Agric Food Chem 1991,39 1094-7.

65. Philip T, Chen T-S. Quantitative analyses of major carotenoid fatty acid esters in fruits by liquid chromatography persimmon and papaya J Food Science 1988;53:1720-2.

66. Moorthy SN, Jos JS, Nair RB, Sreekumari MT. Variability of ß-carotene content in cassava germplasm. Food Chem 1990,36·233-6

67. Rodriguez DB, Raymundo LC, Lee T-C, Simpson KL, Chichester CO. Carotenoid pigment changes in ripening *Momordica charantia* fruits. Ann Bot 1976;40.615-24.

68. Rouseff RL, Sadler GD, Putnam TJ, Davis JE. Determination of ß-carotene and other hydrocarbon carotenoids in red grapefruit cultivars. J Agric Food Chem 1992;40·47-51.

69. Tavares CA, Rodriguez-Amaya DB. Carotenoid composition of Brazilian tomato and tomato products. Lebensm Wiss Technol. (submitted).

70. Ershow AG, Wong-Chen KW. Chinese food composition tables. J Food Comp Anal 1990;3:191-434.

71. AOAC. Official methods of analysis, 14th ed. Association of Official Analytical Chemists, Washington, 1984.

72. Gebhardt SE, Elkins ER, Humphrey J. Comparison of two methods for determining the vitamin A value of clingstone peaches. J Agric Food Chem 1977;25.629-31.

73. Speek AJ, Temalilwa CR, Schrijver J. Determination of ß-carotene content and vitamin A activity of vegetables by high-performance liquid chromatography and spectrophotometry. Food Chem 1986;19:65 74.

74. Bushway RJ, Wilson AM Determination of α- and ß-carotene in fruit and vegetables by high performance liquid chromatography Can Inst Food Sci Technol 1982,15 165-9.

75 Bushway RJ Separation of carotenoids in fruits and vegetables by high performance liquid chromatography J Liq Chromatogr 1985,8 1527-47

76 Thompson JN, Duval S, Verdier P Investigation of carotenoids in human blood using high-performance liquid chromatography J Micronutr Anal 1985,1 81-91

77 Holland B, Unwin ID, Buss DH First supplement to the McCance & Widdowson's The composition of foods, 4th edition Vegetables, herbs and spices Cambridge Royal Society of Chemistry, 1991

78 Schwartz SJ, Woo SL, Elbe JH High performance liquid chromatography of chlorophylls and their derivatives in fresh and processed spinach J Agric Food Chem 1981,29 533-5

79 Gopalan C, Rama Sastri BV, Balasubramanian SC Nutritive value of Indian Foods. National Institute of Nutrition, Hyderabad

80 Vaidya Y Carotene content of some prominent food plants of Nepal, 1993 (personal communication)

81. Nezam El-Din AMM, El-Feky MS Chemical changes during the preservation of some vegetables, I - Egyptian mallow, spinach and peas Egypt J Food Sci 1991,19:115-27.

82. Saleh N, El-Hawary Z, El-Shobaki FA, Abbassy M, Morcos SR Vitamin content of fruits and vegetables in common use in Egypt Zeitschrift fur Ernahrungswissenschaft, 1977

83. Cravioto R, Massieu G et al Composición de alimentos mexicanos Instituto Nacional de Nutriologia, 1942.

84. Skurjkhin I. Carotenoid content of Russian fruits and vegetables, 1993 (personal communication)

85. Kaic-Rak A Carotenoid content of selected Croatian foods, 1993 (personal communication).

86 VITAL Effect of preparation and preservation techniques on vitamin content of indigenous foods. Progress Report I Indonesia 1993.

87 Burlingame B Carotenoid content of New Zealand Foods, 1993 (personal communication)

88. Strmiska F, Hočíková K. Uber den Gehalt an Carotenoiden in einiger Obstarten und Obstprodunkten tschechoslowakischer Provenienz Fluss Obst 1969,36:1-4

89. Hidaka T, Anno T, Nakatsu S The composition and vitamin a value of the carotenoids of pumpkins of different colors J Food Biochem 1987,11 59-68.

90. Wolde-Gebriel Z ß-Carotene content of fruits and vegetables commonly consumed in Ethiopia, 1993 (personal communication)

91. Vollebregt YCJ, Feskens EJM Samenstelling van voedingsmiddelentabellen met gehalten aan retinol en ß-caroteen, vitamine E en pectine ten behoeve van o a. de Zutphen-studie RIVM, Rapport nr 441111 002, 1993

92 McDowell I, Oduro KA Investigation of the beta-carotene content of yellow varieties of cassava (*Manihot Esculenta* crantz) J Plant Foods 1983,5 169-71

93 Philip T, Chen TS, Nelson DB Liquid chromatographic profiles of major carotenoid esters in commercially processed california navel and valencia juice concentrates. J Chrom 1988,442 249-65

94. Kajadphai A The determination of vitamin A and carotenoids in plasma and food (fruits and vegetables) Geelong, Deakin University, 1993

95 Kapeller K, (editor) A fűszerpaprika nagyüzemi termesztéstechnológiája. Mezőgazdasági Kiadó, Budapest, 1980·48

96. Lewis J The carotenoid content of foods from the Australian Nutrient Data Bank, 1993 (personal communication)

97 Mangels AR, Holden JM, Beecher GR, Forman MR, Lanza E Carotenoid content of fruits and vegetables An evaluation of analytical data J Am Diet Assoc 1993;93·284-96.

98 Greenfield H, Southgate DAT Food composition data production, management and use. London and New York· Elsevier Applied Science, 1992.

99. Pepping F, Vencken CMJ, West CE Retinol and carotene content of foods consumed in East-Africa determined by high performance liquid chromatography J Sci Food Agric 1988;45:359-71.

100. Underwood BA. Vitamin A in animal- and human nutrition In. Sporn MB, Roberts AB, Goodman DS (editors): The Retinoids. Orlando FL Academic Press, 1984; vol 1. 281-392.

101. Hardinsyah, Briawan D Penilaian dan perencanaan [illegible] pangan (Food composition· calculation and planning) Bogor. Institut Pertanian Bogor, Fakultas Pertanian, 1990 140pp

102. Nio OK. Daftar analysis bahan makanan (List of food analyses) Jakarta· Universitas Indonesia, Fakultas Kedokteran, 1992 53pp.

103. Puslitbang Gizi. Komposisi zat gizi pangan Indonesia (Indonesian food composition table). Bogor. Puslitbang Gizi, 1990:50pp

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APPENDIX 2. STRUCTURE AND USE OF DATA FILES
General layout of the database files

DATA.DBF

FIELD NAME	FIELD DESCRIPTION
REFNR	Reference number of the publication
FOODNR	Assigned food number
NAME_ENGLI	English name of the food
NAME_SCIEN	Scientific name of the food
COUNTRY	Country of origin of the food
BETA_MN	ß-carotene values (mean)
BETA_SD	ß-carotene values (standard deviation)
BETA_RG	ß-carotene values (range)
ALPHA_MN	α-carotene values (mean)
ALPHA_SD	α-carotene values (standard deviation)
ALPHA_RG	α-carotene values (range)
DELTA_MN	δ-carotene values (mean)
DELTA_SD	δ-carotene values (standard deviation)
DELTA_RG	δ-carotene values (range)
GAMMA_MN	γ- carotene values (mean)
GAMMA_SD	γ-carotene values (standard deviation)
GAMMA_RG	γ-carotene values (range)
ZETA_MN	ζ-carotene values (mean)
ZETA_SD	ζ-carotene values (standard deviation)
ZETA_RG	ζ-carotene values (range)
A_CRYP_MN	α-crypthoxanthin values (mean)
A_CRYP_SD	α-crypthoxanthin values (standard deviation)
A_CRYP_RG	α-crypthoxanthin values (range)
B_CRYP_MN	ß-crypthoxanthin values (mean)
B_CRYP_SD	ß-crypthoxanthin values (standard deviation)
B_CRYP_RG	ß-crypthoxanthin values (range)
LYCO_MN	Lycopene values (mean)

APPENDIX 2. (continued)

LYCO_SD	Lycopene values (standard deviation)
LYCO_RG	Lycopene values (range)
LUTEIN_SD	Lutein values (standard deviation)
LUTEIN_RG	Lutein values (range)
VIOLAX_MN	Violaxanthin values (mean)
VIOLAX_SD	Violaxanthin values (standard deviation)
VIOLAX_RG	Violaxanthin values (range)
ZEAX_MN	Zeaxanthin values (mean)
ZEAX_SD	Zeaxanthin values (standard deviation)
ZEAX_RG	Zeaxanthin values (range)
TOTAL_MN	Total carotenoids (mean)
TOTAL_SD	Total carotenoids (standard deviation)
TOTAL_RG	Total carotenoids (range)
OTHER	Other carotenoid values
NOTES	Notes and other relevant remarks
REQ	Retinol equivalents

FOOD.DBF

FIELD NAME	DESCRIPTION of FIELD
REFNR	Reference number of the publication
FOODNR	Assigned food number
DATE_ENTRY	Date of entry
DATE_CHANG	Date of entry changes
NAME_ENGLI	English name of the food
NAME_SCIEN	Scientific name of the food
TYPE	Type, strain, brand, variety
MATU_RIPE	Maturity/ripeness of plant, vegetable, fruit
PART_PLANT	Part of the plant, vegetable, fruit analysed
EDIBLE_POR	Edible portion of the food (%)
EUROCODE_2	Eurocode 2 food number
N_SAMPLES	Number of samples analysed

APPENDIX 2. (continued)

WEIGHT_SAM	Weight of the samples
ORIGIN	Origin of the food
COUNTRY	Country (and place) of origin of the food
N_GEO_AREA	Number of the geographical area
STORAGE	Storage of the food samples
PROCESSING	State of the analysed food sample (raw, steamed, cooked)
MOISTURE	Moisture content of the food (%)
NOTES	Notes and other remarks

METHOD.DBF

FIELD NAME	FIELD DESCRIPTION
REFNR	Assigned reference number
AUTHOR	First author name of the reference
EXTR_NR	Extraction method number
ANTI_STAB	Kind of anti-oxidants/stabilizers used
LIGHT	Protection from light sources
N2	Under stream of oxygen yes/no
NEUTRAL	Kind of neutralizing agents used
E_REAG	Extraction reagent(s)
E_TIME	Extraction duration
E_COMPL	Completion criteria of extraction
SAPONIFIED	Saponified samples yes/no
S_REAG	Saponification reagent(s)
S_TIME	Saponification duration
S_TEMP	Saponification temperature
PR_METHOD	Principle method employed
C_NR	Chromatographic method number
LENGTH	Length of HPLC column (mm)
D_COLUMN	Diameter of HPLC column (mm)
STATPHASE	Stationary phase
NAME	Common/commercial name of the column

APPENDIX 2. (continued)

D_PARTICLE	Diameter of particle (μm)
TYPE	Type of elution (isocratic, gradient, etc.)
ELUENTS	Eluents used for chromatography
FLOW	Flow rate (ml/min)
REFMATER	Reference materials used
INT_STAND	Internal standard(s) used
PEAK_ID	Peak identification
QUANTIFIC	Quantification of carotenoids
RECOVERY	Recovery percentage
COMP_ANAL	Comparative analyses mentioned
INTERLAB	Interlaboratory trials mentioned
OTHERNUTR	Other nutrients determined yes/no
M_NOTES	Notes, remarks on method employed
QM	Quality measure of method employed

Selection of information from database files

The structure of the final database was determined by the data which was considered to be useful for inclusion in the published table (Chapter 3). In addition, the width of the table and the type fonts available had to be taken into account. The following selection of data was made:

From **food.dbf**:

Field name	Description of field
REFNR	Reference to the publication
NAME_ENGLI	English name of the food
NAME_SCIEN	Scientific name of the food
TYPE	Type, strain, brand, variety
PART_PLANT	Part of the plant
EDIBLE_PORT	Edible portion of the food (%)
PROCESSING	Cooking method (if given)
MOISTURE	Moisture content (%)

APPENDIX 2. (continued)

From **method.dbf**:

Field name	Description of field
PR_METHOD	Principle method used*
EXTR_NR	Reference to extraction procedure
CHROM_NR	Reference to chromatographic procedure
QM	Quality measure

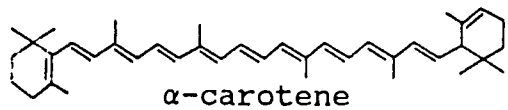
* HPLC, high-performance liquid chromatography
OCC, open-column chromatography

From **data.dbf**

Field name	Description of field
ALPHA_MN	Alpha-carotene (mean)
ALPHA_RG	Alpha-carotene (range)
BETA_MN	Beta-carotene (mean)
BETA_RG	Beta-carotene (range)
B_CRYP_MN	Beta-cryptoxanthin (mean)
B_CRYP_RG	Beta-cryptoxanthin (range)
LYCO_MN	Lycopene (mean)
LYCO_RG	Lycopene (range)
LUTEIN_MN	Lutein (mean)
LUTEIN_RG	Lutein (range)
ZEAX_MN	Zeaxanthin (mean)
ZEAX_RG	Zeaxanthin (range)
TOTAL_MN	Total carotenoids (mean)
TOTAL_RG	Total carotenoids (range)
REQ	Retinol equivalents

The data selected were combined by linking the three data files through the foodnr field present in the food dbf and data dbf files and the refnr field in the data dbf and the method dbf files The procedure used was as described in the dBASE IV manual which can be consulted if the data are required in a different format

APPENDIX 3 CHEMICAL STRUCTURE OF CAROTENOIDS



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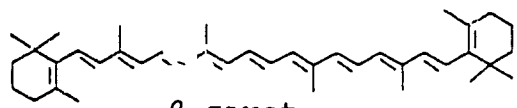

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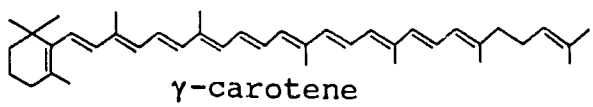

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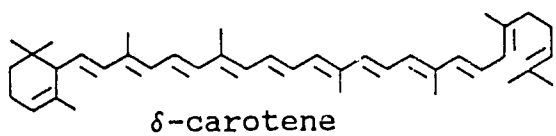

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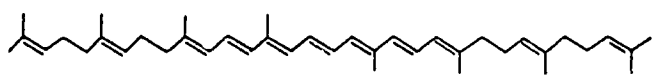

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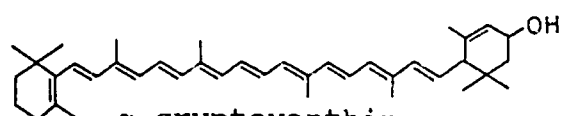

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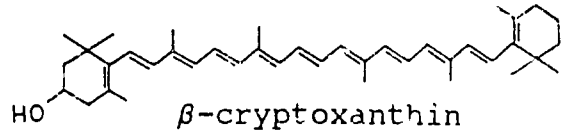
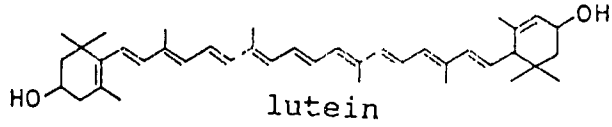
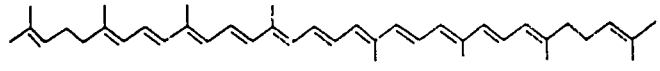


β-cryptoxanthin



lutein



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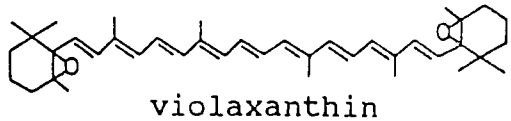

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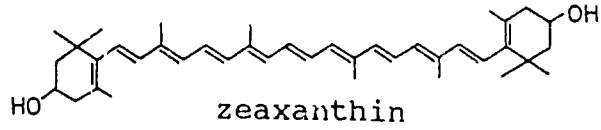

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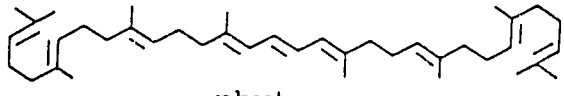

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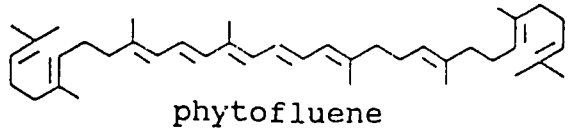

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