

USDA Database for the Proanthocyanidin Content of Selected Foods

Prepared by

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Documentation

Proanthocyanidins (PAs), the polymers of flavan-3-ols, also referred to as ‘Condensed Tannins’, are known for contributing astringent flavor to foods. Recently it has been hypothesized that the free radical scavenging properties of PAs may reduce the risk of cardiovascular diseases (Reed, 2002; Steinberg, et al 2003), cancer (Bagchi, et al 2000), blood clotting (Murphy, et al 2003) and certain types of trimeric PAs may protect against urinary tract infections (Foo, et al 2000). A database for PAs is needed for epidemiologists and health researchers to estimate the intakes and to investigate relationships between intakes and reduction in the risks of various diseases. USDA scientists have developed a Special Interest Database for PAs in selected foods in collaboration with scientists at the Arkansas Children’s Nutrition Center, Little Rock, AR., Mars, Inc., Hackettstown, N.J. and Ocean Spray Cranberries, Inc., Lakeville, Mass. This database complements the previously released database, “USDA Database for Flavonoid Contents in Selected Foods”, which contains values for 26 monomeric compounds in five subclasses of dietary flavonoids: Flavonols, flavones, flavanones, flavan-3-ols and anthocyanidins.

Data Sources

The database contains analytical data generated by the ARS scientists at Arkansas Children’s Nutrition Center (Ref. 13, Sources of Data) as well as other published analytical data. Food samples analyzed by the Arkansas Center were procured under the National Food and Nutrient Analysis Program (NFNAP) of the Nutrient Data Laboratory (NDL) of the USDA. Fresh produce samples were obtained from retail supermarkets in four regions of the United States during two different seasons. Similar foods were composited by season and region, frozen, homogenized and freeze-dried to stabilize the proanthocyanidin content. Samples were shipped frozen on dry ice and kept at -70°C until analysis. Processed and prepared products as well as nuts, cereals/beans, and snacks were ground without freeze-drying. Beverages were analyzed in their original liquid form. The normal-phase High Performance Liquid Chromatography (HPLC) method developed by Hammerstone, et al (1999) and optimized by Adamson, et al (1999) and Gu, et al (2002, 2003) was applied for the analysis and quantitation of PAs. This method separates and quantifies all compounds from mono- to decamers individually and polymers with degrees of polymerization (DPs) greater than ten as a single peak. Gu, et al validated this method to demonstrate the efficiency of extraction and specificity of separation and quantification. The risk of contamination of polymers with non-proanthocyanidin (non-PA) compounds is minimal due to the limited occurrence of these compounds in most foods. Non-PA compounds may occur in wines and strawberries.

In addition, previously published data were collected through searches of scientific literature databases. Data from analytical studies that used only acceptable analytical methods (HPLC methods, both normal and reverse phase) were considered for inclusion. The reverse phase HPLC method is not suitable for separating the compounds with DPs higher than three (Adamson, et al 1999). Since a number of studies, using the reverse phase HPLC method, are included in the database, compounds with DPs >3 may not be reported for all foods. Analytical methods, (i.e. Folin-Ciocalteu and Vanillin assay) which are not specific for PAs only and quantify only total PAs but not individual compounds were not considered acceptable.

Data Management

The PAs are polymers of flavan-3-ols or flavanols. Procyanidins (polymers of [epi] catechin) are the most common proanthocyanidins in foods, however prodelphinidins (derived from [epi] gallocatechin) and propelargonidins (derived from afzelechin) also have been identified (Santos-Buelga and Scalbert 2000; Gu, et al 2004). See Figure 1.

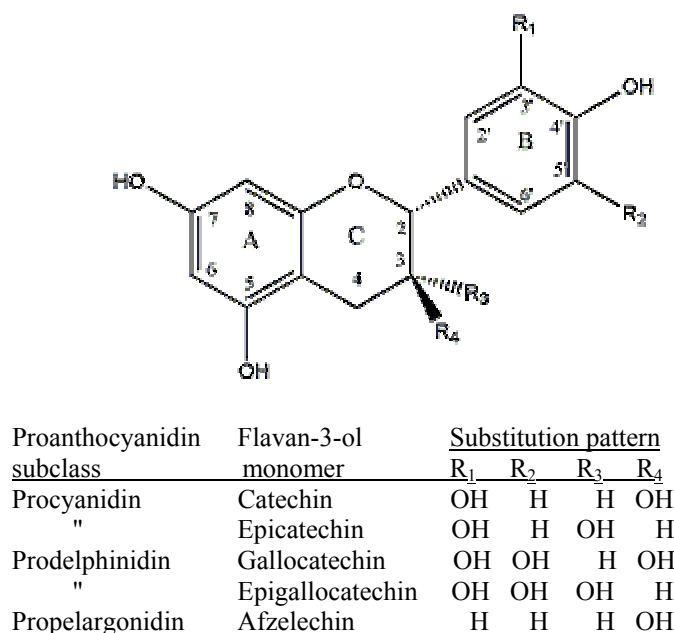


Figure 1. Structure of common flavan-3-ols and substitution patterns found in proanthocyanidins extracted from foods.

The most common flavanol-flavanol linkages are C-C bonds (B-type, 4→6 or 4→8), but occasionally mixed double linkages occur (A type, 4→8, 2→7). See Figure 2.

Unfortunately analytical technology has not advanced to the stage where each of these proanthocyanidins as well as A-type linkages can be quantified separately. Nonetheless, mass spectrometric detection systems, which have been employed for much of the current proanthocyanidin data, can qualitatively distinguish among the oligomers of varying polymerization degree and the various intermonomeric linkages. Therefore the data in this table are a summation of all forms of proanthocyanidins for a given oligomeric fraction. The monomers, dimers and trimers are reported individually, while tetramers, pentamers and hexamers are grouped together as 4-6mers; and heptamers, octamers, nonamers and decamers are grouped together as 7-10mers. Polymers (DP>10) are reported as a separate group. All the values are reported as mg/100g of fresh weight of edible portion, except for grape seeds and skins. Although grape seeds and skins are not consumed as such, their contents of PAs are of great importance to wine makers. Therefore their values are included in the database. If a value was reported as "Trace" an estimate was calculated by multiplying the Limit of Quantitation (LOQ) by a factor of 0.71 (Mangels, et al 1993) to reflect the area under the curve below the LOQ, if the LOQ was available. A zero value reported in the database should be

considered as a true zero (below the limit of detection, LOD), indicating that authors attempted to measure the compound in that food and did not find it. The lack of a value for a particular compound(s) does not imply a zero value, but only that data were unavailable. The table of analytical values contains values for only those compounds and foods that were available at the time of this survey; it does not mean that other compounds were not present in that particular food or foods not included in the database do not contain PAs. Most of the data, except for the data generated by the Arkansas Nutrition Center, reported values for monomers, dimers and trimers only because most of the analysts used the reverse phase HPLC method for separating the compounds.

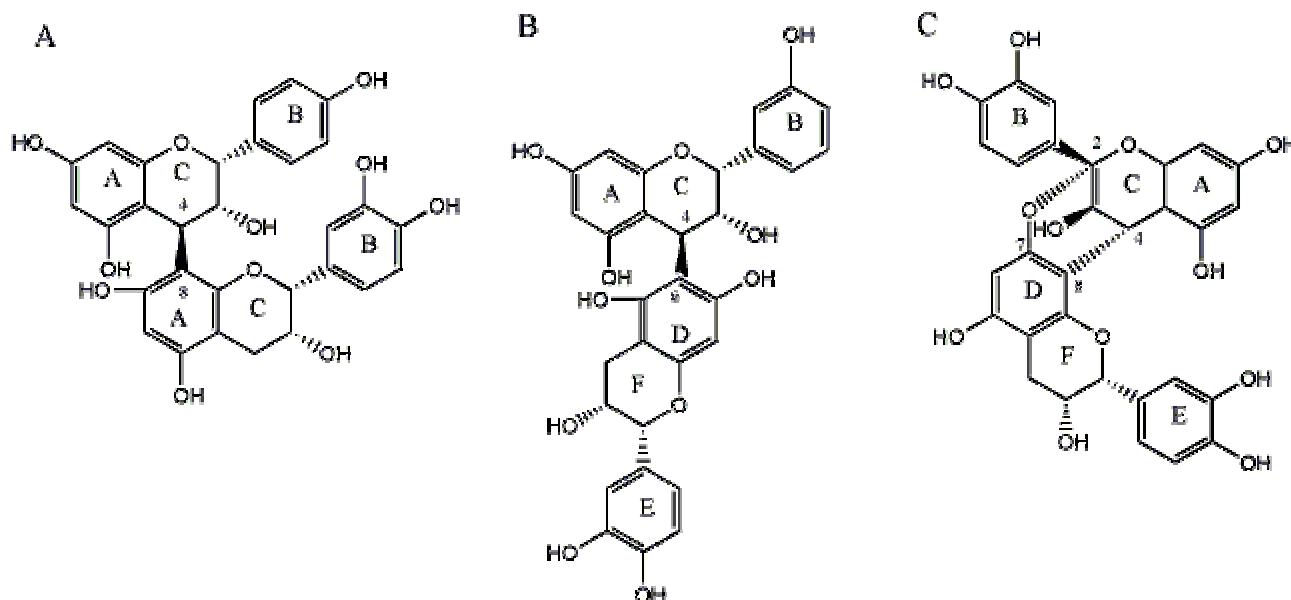


Figure 2. Common interflavan linkages found in proanthocyanidins extracted from foods. A) B type 4→8 linkage [Epicatechin-(4\$→\$8)-epicatechin], B) B type 4→6 linkage [Epicatechin-(4\$→\$6)-epicatechin], C) A type linkage [Epicatechin-(2\$→\$7, 4\$→\$8)-epicatechin]. From Porter, 1994.

Data Quality Evaluation

All data were evaluated for quality using the procedures developed by the NDL scientists (Holden, et al 2002). Categories of documentation evaluated include: sampling plan, sample handling, number of samples, analytical method and analytical quality control. The information presented in each manuscript was evaluated for each category, which then received a rating ranging from 0 to 20 points. The ratings for all the five categories were summed to yield a Quality Index (QI) with a maximum score of 100 points. The Confidence Code (CC) was derived from the QI and is an indicator of relative quality of the data and reliability of a given mean. Each food and compound in the database has a CC. Different foods from the same study may have different CCs depending on the sampling procedure used or the number of samples analyzed.

The CC was assigned as follows:

<u>QI</u>	<u>CC</u>
75-100	A
74-50	B
49-25	C
<25	D

Data Aggregation and Format

Data for similar forms of a food were grouped and aggregated to match the food entries or food descriptions in the USDA Nutrient Database for Standard Reference (SR). Each food was given a Nutrient Data Bank (NDB) number, a five digit numerical code used in the SR. Temporary NDB numbers, beginning with “97”, were assigned to foods that are not included in the SR and the numbers are not unique to this table or to a food, as they may have been used in other special interest databases produced by the NDL. Subsequently, the mean value (mg/100g), standard deviation of each mean (SD), minimum (Min.) and maximum (Max.) values were determined for each food and PA compound or group of compounds. The various studies reported values as either individual values or as means, with additional statistical information. As a result, means in the database may be calculated either from individual values or as a mean of means, or as a combination of these. Mean values per study were weighted to account for the different number of samples among the various studies used. The weighted mean from each data source was, in turn, used to calculate the standard deviation based on the total number of samples in each aggregated food. The data quality ratings for each category were reevaluated for the mean value of each food and each compound. Ratings may change at this stage. For example, number of samples in the aggregate may increase which may increase the rating for that category. This, in turn, may increase the QI and the CC. The values along with the confidence codes and sources of data are given in Table 1. Foods in Table 1 are arranged in alphabetical order.

Format of Table 1 – USDA Database for the Proanthocyanidin Content of Selected Foods

This table contains proanthocyanidin values for 205 foods. The fields are as follows:

Field name	Field description
NDB No.	USDA Nutrient Data Bank Number
Description	Food description
Proanthocyanidin	Name of individual or group of PAs
Mean	Mean value (mg/100g edible portion)
SD	Standard Deviation of the Mean (mg/100g edible portion)
N	Number of samples
Min.	Minimum value (mg/100g edible portion)
Max.	Maximum value (mg/100g edible portion)
CC	Confidence Code
Sources of data	Data source/s from which values were obtained

Table 2 provides a list of foods where PAs were not detected. Similarly Table 3 provides a list of foods that contain proanthocyanidins other than procyanidins (prodelphinidins and propelargonidins) and double linkages (A-type). All three tables along with the references for sources of data are available on the NDL website: www.nal.usda.gov/fnic/foodcomp.

A review of these data for proanthocyanidins indicates variability in levels of specific PAs. A plant's genetic predisposition dictates the biosynthesis of the primary (sugars, amino acids, etc.) and secondary metabolites (i.e. proanthocyanidins, saponins, alkaloids, etc.). Variability with respect to secondary metabolites can exist between varieties (or cultivars) of the same species. This is quite apparent with data presented herein for apple and grape. However, various environmental factors determine the extent to which genetic potentialities are achieved. Ecology, drought, soil type/structure, disease, herbivore damage, and farming practices (i.e. pruning, application of pesticides, etc.) do have an influence on secondary plant metabolism. The post-harvest handling (storage time, temperature, modified atmospheres, etc.) of fruits and vegetables can also impact metabolite levels. Processing effects such as heating, fermentation, shearing, etc. can influence the final levels of these compounds. Finally, variability in food component values may be attributable to the differences in analytical methods used to determine the values.

When food composition data are being reviewed and evaluated it is important to distinguish variability due to factors intrinsic to the food or food processing from factors inherent to the measurement process. It is not possible at this stage to separate the sources and magnitude of effects to biological or analytical variability. In this database values came from limited sources and were based on a limited number of samples. This may also account for the apparent higher variability in the PA contents. Comparisons for raw and processed foods are not valid unless paired samples are used for both the raw and processed foods. But the preliminary observations did show considerable loss of PAs after cooking, e.g. raw and cooked pinto beans (796 vs 21 mg/100g respectively). Therefore it is important to study the effects of processing on PA contents in the future studies.

Limitations of the Data: This is a “provisional database” for proanthocyanidins in foods. The analytical data presented in this database are the result of much work and the development and use of state-of-the-art methodologies for the quantitative analysis of proanthocyanidins. However, it is recognized that these methods have not addressed all the technical issues that still remain for the most accurate, representative assessment of the proanthocyanidin content of foods. Therefore, this database should be used carefully in drawing conclusions about absolute values for proanthocyanidins. Instead, as stated in the introductory paragraph, this database should be considered an important tool for developing hypotheses about the relationships between the intake of proanthocyanidins and various disease states, to help develop and set priorities for continued investigation, characterization and improved quantitation of the proanthocyanidin content of foods.

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Table 1. USDA Database for the Proanthocyanidin Content of Selected Foods – 2004

(for mean, standard deviation, min and max, units = mg/100 g, edible portion)

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NDB No.	Description	Proanthocyanidin	Mean ¹	SD	N	Min	Max	CC	Sources of Data
14003	Alcoholic beverage, beer, regular	Monomers	0.63	0.27	7	0.26	1.01	B	8, 13, 16, 19
		Dimers	0.85	0.45	7	0.08	1.17	B	8, 13, 16, 19
		Trimers	0.15	0.08	6	0.07	0.30	B	8, 13, 19
		4-6mers	0.40		2	0.40	0.40	B	13
		7-10mers	0.00		2	0.00	0.00	B	13
		Polymers	0.00		2	0.00	0.00	B	13
14096	Alcoholic beverage, wine, table, red	Monomers	16.64	4.57	68	0.78	35.82	B	7, 8, 10, 11, 13, 15, 29
		Dimers	20.49	5.67	70	0.73	42.70	B	7, 8, 10, 11, 13, 15, 22, 29
		Trimers	1.80	1.01	11	0.22	4.12	B	7, 8, 10, 13, 15, 22
		4-6mers	6.70		2	6.70	6.70	B	13
		7-10mers	5.00		2	5.00	5.00	B	13
		Polymers	11.00		2	11.00	11.00	B	13
14104	Alcoholic beverage, wine, table, rose	Monomers	1.33	0.00	3	1.33	1.33	C	8
		Dimers	0.86	0.00	3	0.86	0.86	C	8
		Trimers	0.01	0.00	3	0.01	0.01	C	8
14106	Alcoholic beverage, wine, table, white	Monomers	0.59	0.07	44	0.17	0.66	B	5, 8, 29
		Dimers	0.21	0.03	45	0.04	0.26	B	5, 8, 23, 29
		Trimers	0.01	0.02	4	0.00	0.04	C	8, 23
09016	Apple juice, canned or bottled, unsweetened, without added ascorbic acid	Monomers	4.96	7.26	25	0.08	28.60	B	13, 17, 24, 27, 28
		Dimers	4.04	4.19	25	0.00	15.69	B	13, 17, 24, 27, 28
		Trimers	2.74	4.32	10	0.00	11.52	B	13, 27, 28
		4-6mers	0.38		2	0.38	0.38	B	13
		7-10mers	0.10		2	0.10	0.10	B	13
		Polymers	0.00		2	0.00	0.00	B	13
97066	Apples, Fuji, with peel, raw	Monomers	6.46	1.68	4	4.15	8.19	A	13
		Dimers	9.92	2.64	4	6.48	12.90	A	13
		Trimers	6.09	1.43	4	4.29	7.78	A	13
		4-6mers	19.09	4.31	4	13.76	24.32	A	13
		7-10mers	13.81	2.79	4	10.62	17.43	A	13
		Polymers	14.22	3.06	4	11.18	18.48	A	13
97067	Apples, Gala, with peel, raw	Monomers	5.94	0.38	3	5.50	6.22	A	13
		Dimers	9.55	0.30	3	9.26	9.86	A	13
		Trimers	6.24	0.23	3	6.05	6.49	A	13
		4-6mers	21.28	1.51	3	19.93	22.91	A	13
		7-10mers	18.73	1.36	3	17.74	20.28	A	13
		Polymers	30.68	5.56	3	26.63	37.02	A	13

¹ Table contains data for those compounds where analytical data were available; lack of data does not mean the compound is not present in a particular food.

Table 1. USDA Database for the Proanthocyanidin Content of Selected Foods – 2004

(for mean, standard deviation, min and max, units = mg/100 g, edible portion)

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NDB No.	Description	Proanthocyanidin	Mean ¹	SD	N	Min	Max	CC	Sources of Data
97069	Apples, Golden Delicious, with peel, raw	Monomers	3.71	1.02	7	2.34	5.00	A	8, 13
		Dimers	7.59	2.24	7	4.58	10.34	A	8, 13
		Trimers	4.73	1.37	7	2.88	6.40	A	8, 13
		4-6mers	21.77	1.21	4	20.58	23.17	A	13
		7-10mers	18.75	1.01	4	17.55	19.98	A	13
		Polymers	26.46	2.77	4	23.17	29.78	A	13
97068	Apples, Golden Delicious, without peel, raw	Monomers	4.02	0.04	11	4.00	4.15	A	6, 13
		Dimers	6.62	1.28	11	6.00	9.80	A	6, 13
		Trimers	5.79		2	5.44	6.13	A	13
		4-6mers	21.16		2	19.31	23.01	A	13
		7-10mers	17.54		2	15.27	19.80	A	13
		Polymers	22.40		2	18.39	26.40	A	13
97070	Apples, Granny Smith, with peel, raw	Monomers	5.68	1.93	7	3.26	8.86	A	8, 13
		Dimers	12.76	2.78	7	9.71	18.37	A	8, 13
		Trimers	8.24	1.38	7	7.07	11.35	A	8, 13
		4-6mers	32.90	5.85	4	29.23	41.55	A	13
		7-10mers	30.12	6.14	4	26.36	39.26	A	13
		Polymers	46.31	9.52	4	37.84	59.93	A	13
09004	Apples, raw, without peel, raw	Monomers	7.50	2.23	18	1.00	14.00	C	6
		Dimers	9.50	1.89	18	4.00	15.00	C	6
97072	Apples, Red Delicious, with peel, raw	Monomers	8.31	3.73	7	6.42	10.16	A	8, 13
		Dimers	15.12	6.49	7	9.61	18.32	A	8, 13
		Trimers	10.11	4.34	7	6.44	12.15	A	8, 13
		4-6mers	28.59	15.26	4	21.37	32.62	A	13
		7-10mers	25.12	13.45	4	19.24	30.35	A	13
		Polymers	40.54	22.20	4	32.67	54.25	A	13
97071	Apples, Red Delicious, without peel, raw	Monomers	6.81		2	6.19	7.44	A	13
		Dimers	11.29		2	10.17	12.41	A	13
		Trimers	7.18		2	6.48	7.88	A	13
		4-6mers	24.33		2	21.95	26.71	A	13
		7-10mers	20.31		2	18.11	22.51	A	13
		Polymers	28.75		2	23.75	33.75	A	13
97084	Apples, Renette, with peel, raw	Monomers	8.27	0.00	3	8.27	8.27	C	8
		Dimers	23.16	0.00	3	23.16	23.16	C	8
		Trimers	11.45	0.00	3	11.45	11.45	C	8
09021	Apricots, with peel,	Monomers	1.32	0.89	5	0.33	2.80	B	8, 13

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NDB No.	Description	Proanthocyanidin	Mean ¹	SD	N	Min	Max	CC	Sources of Data
	raw	Dimers	1.33	1.06	5	0.15	3.10	B	8, 13
		Trimers	0.77	0.68	5	0.01	1.90	B	8, 13
		4-6mers	4.90		2	4.90	4.90	B	13
		7-10mers	2.20		2	2.20	2.20	B	13
		Polymers	0.80		2	0.80	0.80	B	13
09038	Avocados, raw, California	Monomers	0.96	0.78	8	0.00	2.12	A	13
		Dimers	1.46	0.84	8	0.54	3.28	A	13
		Trimers	1.36	0.65	8	0.00	2.12	A	13
		4-6mers	3.17	2.07	8	0.00	5.79	A	13
		7-10mers	0.44	0.71	8	0.00	1.96	A	13
		Polymers	0.00	0.00	8	0.00	0.00	A	13
97021	Babyfood, apricots with pears and apples	Monomers	1.70		1			B	13
		Dimers	3.40		1			B	13
		Trimers	2.30		1			B	13
		4-6mers	7.60		1			B	13
		7-10mers	4.60		1			B	13
		Polymers	0.00		1			B	13
97022	Babyfood, banana, plum, grape	Monomers	1.10		1			B	13
		Dimers	2.50		1			B	13
		Trimers	1.90		1			B	13
		4-6mers	8.10		1			B	13
		7-10mers	7.10		1			B	13
		Polymers	4.40		1			B	13
97024	Babyfood, banana, strawberry	Monomers	0.40		1			B	13
		Dimers	1.00		1			B	13
		Trimers	0.90		1			B	13
		4-6mers	3.80		1			B	13
		7-10mers	3.30		1			B	13
		Polymers	2.80		1			B	13
03181	Babyfood, cereal, barley, dry	Monomers	4.80		1			B	13
		Dimers	9.30		1			B	13
		Trimers	4.50		1			B	13
		4-6mers	4.10		1			B	13
		7-10mers	0.00		1			B	13
		Polymers	0.00		1			B	13
97025	Babyfood, dessert, blueberry buckle	Monomers	0.70		1			B	13
		Dimers	1.80		1			B	13
		Trimers	1.30		1			B	13
		4-6mers	5.30		1			B	13
		7-10mers	4.40		1			B	13
		Polymers	4.40		1			B	13
03225	Babyfood, dessert,	Monomers	1.60		1			B	13

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(for mean, standard deviation, min and max, units = mg/100 g, edible portion)

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NDB No.	Description	Proanthocyanidin	Mean ¹	SD	N	Min	Max	CC	Sources of Data
	cherry vanilla pudding, junior	Dimers	2.70		1			B	13
		Trimers	1.70		1			B	13
		4-6mers	5.20		1			B	13
		7-10mers	2.90		1			B	13
		Polymers	0.00		1			B	13
03165	Babyfood, fruit, apple and blueberry, junior	Monomers	2.90		1			B	13
		Dimers	5.10		1			B	13
		Trimers	2.80		1			B	13
		4-6mers	7.80		1			B	13
		7-10mers	5.20		1			B	13
		Polymers	2.20		1			B	13
97020	Babyfood, fruit, Apple, Strawberry, banana	Monomers	3.00		1			B	13
		Dimers	7.30		1			B	13
		Trimers	4.30		1			B	13
		4-6mers	14.90		1			B	13
		7-10mers	10.60		1			B	13
		Polymers	14.00		1			B	13
97018	Babyfood, Fruit, apples, organic	Monomers	3.80		1			B	13
		Dimers	8.90		1			B	13
		Trimers	5.10		1			B	13
		4-6mers	17.80		1			B	13
		7-10mers	12.30		1			B	13
		Polymers	14.80		1			B	13
03116	Babyfood, fruit, applesauce, strained	Monomers	3.40		1			B	13
		Dimers	6.40		1			B	13
		Trimers	3.60		1			B	13
		4-6mers	9.80		1			B	13
		7-10mers	6.10		1			B	13
		Polymers	0.00		1			B	13
97017	Babyfood, fruit, bananas	Monomers	0.00		1			B	13
		Dimers	0.00		1			B	13
		Trimers	0.00		1			B	13
		4-6mers	0.00		1			B	13
		7-10mers	0.00		1			B	13
		Polymers	0.00		1			B	13
97019	Babyfood, fruit, peaches	Monomers	1.85	0.12	4	1.70	2.00	B	13
		Dimers	3.80	0.33	4	3.40	4.20	B	13
		Trimers	2.80	0.08	4	2.70	2.90	B	13
		4-6mers	8.75	0.69	4	7.90	9.60	B	13
		7-10mers	5.75	0.45	4	5.20	6.30	B	13
		Polymers	0.00	0.00	4	0.00	0.00	B	13
03132	Babyfood, fruit,	Monomers	1.55	0.37	4	1.10	2.00	B	13

Table 1. USDA Database for the Proanthocyanidin Content of Selected Foods – 2004

(for mean, standard deviation, min and max, units = mg/100 g, edible portion)

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NDB No.	Description	Proanthocyanidin	Mean ¹	SD	N	Min	Max	CC	Sources of Data
	pears, strained	Dimers	2.65	0.45	4	2.10	3.20	B	13
		Trimers	1.80	0.24	4	1.50	2.10	B	13
		4-6mers	5.70	0.57	4	5.00	6.40	B	13
		7-10mers	3.65	0.04	4	3.60	3.70	B	13
		Polymers	0.00	0.00	4	0.00	0.00	B	13
43007	Babyfood, fruit, tutti frutti, junior	Monomers	0.00		1			B	13
		Dimers	0.00		1			B	13
		Trimers	0.00		1			B	13
		4-6mers	0.00		1			B	13
		7-10mers	0.00		1			B	13
		Polymers	0.00		1			B	13
03166	Babyfood, juice, apple	Monomers	0.09		1			B	13
		Dimers	0.19		1			B	13
		Trimers	0.19		1			B	13
		4-6mers	0.47		1			B	13
		7-10mers	0.09		1			B	13
		Polymers	0.00		1			B	13
43408	Babyfood, juice, pear	Monomers	0.03		1			B	13
		Dimers	0.09		1			B	13
		Trimers	0.09		1			B	13
		4-6mers	0.00		1			B	13
		7-10mers	0.00		1			B	13
		Polymers	0.00		1			B	13
97064	Babyfood, juice, white grape	Monomers	0.09		1			B	13
		Dimers	0.19		1			B	13
		Trimers	0.19		1			B	13
		4-6mers	0.37		1			B	13
		7-10mers	0.00		1			B	13
		Polymers	0.00		1			B	13
97023	Babyfood, plums with apples	Monomers	1.40		1			B	13
		Dimers	4.00		1			B	13
		Trimers	2.70		1			B	13
		4-6mers	10.30		1			B	13
		7-10mers	7.40		1			B	13
		Polymers	7.30		1			B	13
03091	Babyfood, vegetables, green beans, strained	Monomers	0.00		1			B	13
		Dimers	0.00		1			B	13
		Trimers	0.00		1			B	13
		4-6mers	0.00		1			B	13
		7-10mers	0.00		1			B	13
		Polymers	0.00		1			B	13
03121	Babyfood,	Monomers	0.00		1			B	13

Table 1. USDA Database for the Proanthocyanidin Content of Selected Foods – 2004

(for mean, standard deviation, min and max, units = mg/100 g, edible portion)

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NDB No.	Description	Proanthocyanidin	Mean ¹	SD	N	Min	Max	CC	Sources of Data
	vegetables, peas, strained	Dimers	0.00		1			B	13
		Trimers	0.00		1			B	13
		4-6mers	0.00		1			B	13
		7-10mers	0.00		1			B	13
		Polymers	0.00		1			B	13
03104	Babyfood, vegetables, squash, strained	Monomers	0.00		1			B	13
		Dimers	0.00		1			B	13
		Trimers	0.00		1			B	13
		4-6mers	0.00		1			B	13
		7-10mers	0.00		1			B	13
		Polymers	0.00		1			B	13
19078	Baking chocolate, unsweetened, squares	Monomers	198.54		2	196.40	200.69	A	13
		Dimers	206.51		2	195.64	217.38	A	13
		Trimers	130.88		2	120.26	141.50	A	13
		4-6mers	332.62		2	291.35	373.89	A	13
		7-10mers	216.39		2	176.78	256.00	A	13
		Polymers	551.00		2	418.91	683.09	A	13
09040	Bananas, raw	Monomers	0.13	0.07	7	0.04	0.24	A	8, 13
		Dimers	0.43	0.25	7	0.10	0.80	A	8, 13
		Trimers	0.49	0.36	7	0.00	0.94	A	8, 13
		4-6mers	2.32	0.45	4	1.99	2.98	A	13
		7-10mers	0.00	0.00	4	0.00	0.00	A	13
		Polymers	0.00	0.00	4	0.00	0.00	A	13
20004	Barley	Monomers	3.13	1.57	11	1.00	5.50	C	14, 16
		Dimers	46.11	9.46	11	32.20	59.00	C	14, 16
		Trimers	50.00	10.59	8	33.60	67.10	C	14
16014	Beans, black, mature seeds, raw	Monomers	2.90		2	2.90	2.90	B	13
		Dimers	5.20		2	5.20	5.20	B	13
		Trimers	0.00		2	0.00	0.00	B	13
		4-6mers	0.00		2	0.00	0.00	B	13
		7-10mers	0.00		2	0.00	0.00	B	13
		Polymers	0.00		2	0.00	0.00	B	13
16022	Beans, french, mature seeds, raw	Monomers	0.00	0.00	3	0.00	0.00	C	8
		Dimers	0.00	0.00	3	0.00	0.00	C	8
		Trimers	0.00	0.00	3	0.00	0.00	C	8
16032	Beans, kidney, red, mature seeds, raw	Monomers	16.25	4.61	4	10.60	21.90	B	13
		Dimers	22.90	2.86	4	19.40	26.40	B	13
		Trimers	23.60	4.49	4	18.10	29.10	B	13
		4-6mers	98.85	15.39	4	80.00	117.70	B	13

Table 1. USDA Database for the Proanthocyanidin Content of Selected Foods – 2004

(for mean, standard deviation, min and max, units = mg/100 g, edible portion)

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NDB No.	Description	Proanthocyanidin	Mean ¹	SD	N	Min	Max	CC	Sources of Data
		7-10mers	90.50	12.08	4	75.70	105.30	B	13
		Polymers	258.15	4.29	4	252.90	263.40	B	13
16043	Beans, pinto, mature seeds, cooked, boiled, without salt	Monomers	1.75	0.06	4	1.70	1.82	A	13
		Dimers	4.40	0.36	4	3.90	4.70	A	13
		Trimers	3.91	0.32	4	3.44	4.15	A	13
		4-6mers	10.52	5.46	4	4.24	15.19	A	13
		7-10mers	4.32	5.48	4	0.00	11.43	A	13
		Polymers	1.41	1.66	4	0.00	3.23	A	13
16042	Beans, pinto, mature seeds, raw	Monomers	10.72	4.06	7	5.26	15.94	A	8, 13
		Dimers	19.22	12.69	7	2.16	34.37	A	8, 13
		Trimers	16.18	12.00	7	0.00	29.81	A	8, 13
		4-6mers	125.90	9.21	4	112.69	132.52	A	13
		7-10mers	135.62	10.43	4	120.64	143.75	A	13
		Polymers	459.63	34.15	4	410.41	489.30	A	13
16049	Beans, white, mature seeds, raw	Monomers	0.10	0.00	3	0.10	0.10	C	8
		Dimers	0.03	0.00	3	0.03	0.03	C	8
		Trimers	0.00	0.00	3	0.00	0.00	C	8
43201	Bee Pollen	Monomers	0.00	0.00	3	0.00	0.00	C	8
		Dimers	0.00	0.00	3	0.00	0.00	C	8
		Trimers	0.00	0.00	3	0.00	0.00	C	8
09042	Blackberries, raw	Monomers	3.73	1.59	7	0.84	6.30	A	8, 13
		Dimers	4.45	3.00	7	1.46	9.50	A	8, 13
		Trimers	2.11	2.03	7	0.06	5.84	A	8, 13
		4-6mers	7.27	5.02	4	3.47	14.56	A	13
		7-10mers	4.24	4.47	4	0.64	10.76	A	13
		Polymers	1.51	3.02	4	0.00	6.04	A	13
09050	Blueberries, raw	Monomers	3.46	1.38	11	2.07	5.58	A	8, 13
		Dimers	5.71	2.40	11	1.66	9.48	A	8, 13
		Trimers	4.15	1.85	11	0.73	7.37	A	8, 13
		4-6mers	19.57	3.36	8	15.75	26.04	A	13
		7-10mers	14.55	2.03	8	10.99	17.40	A	13
		Polymers	129.05	47.31	8	58.37	200.62	A	13
97085	Blueberries, wild, raw	Monomers	3.23	0.27	3	2.88	3.40	B	12, 13
		Dimers	8.45	0.86	3	7.36	9.00	B	12, 13
		Trimers	6.56	0.38	3	6.08	6.80	B	12, 13
		4-6mers	25.99	0.45	3	25.70	26.56	B	12, 13
		7-10mers	29.31	2.38	3	27.80	32.32	B	12, 13
		Polymers	255.09	8.39	3	244.48	260.40	B	12, 13
16052	Broadbeans (fava beans), mature seeds, raw	Monomers	80.84	0.00	3	80.84	80.84	C	8
		Dimers	73.48	0.00	3	73.48	73.48	C	8
		Trimers	0.13	0.00	3	0.13	0.13	C	8
20011	Buckwheat flour,	Monomers	3.79		1	3.79	3.79	D	21

Table 1. USDA Database for the Proanthocyanidin Content of Selected Foods – 2004

(for mean, standard deviation, min and max, units = mg/100 g, edible portion)

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NDB No.	Description	Proanthocyanidin	Mean ¹	SD	N	Min	Max	CC	Sources of Data
	whole-groat	Dimers	46.51		1	46.51	46.51	D	21
97031	Buckwheat, hulls	Monomers	1.02		1	1.02	1.02	D	21
		Dimers	43.49		1	43.49	43.49	D	21
97034	Cacao beans	Monomers	1381.28		1	1381.28	1381.28	C	12
		Dimers	831.29		1	831.29	831.29	C	12
		Trimers	785.70		1	785.70	785.70	C	12
		4-6mers	2690.78		1	2690.78	2690.78	C	12
		7-10mers	2224.21		1	2224.21	2224.21	C	12
		Polymers	1568.49		1	1568.49	1568.49	C	12
99321	Candies, dark chocolate	Monomers	79.79	24.86	8	57.20	136.40	C	1, 18
		Dimers	59.05	14.07	8	50.00	94.20	C	1, 18
		Trimers	32.25	11.49	8	20.00	55.60	C	1, 18
		4-6mers	48.10	30.08	8	20.00	118.30	C	1, 18
		7-10mers	14.38	16.77	8	0.00	54.20	C	1, 18
19120	Candies, milk chocolate	Monomers	23.47	3.55	8	20.00	31.18	A	1, 13
		Dimers	23.10	3.09	8	20.00	29.73	A	1, 13
		Trimers	14.65	4.29	8	10.00	22.55	A	1, 13
		4-6mers	40.72	11.08	8	30.00	65.05	A	1, 13
		7-10mers	17.63	15.62	8	0.00	45.42	A	1, 13
		Polymers	32.82	9.17	4	24.84	40.88	A	13
11125	Carrots, cooked, boiled, drained, without salt	Monomers	0.00	0.00	4	0.00	0.00	A	13
		Dimers	0.00	0.00	4	0.00	0.00	A	13
		Trimers	0.00	0.00	4	0.00	0.00	A	13
		4-6mers	0.00	0.00	4	0.00	0.00	A	13
		7-10mers	0.00	0.00	4	0.00	0.00	A	13
		Polymers	0.00	0.00	4	0.00	0.00	A	13
11124	Carrots, raw	Monomers	0.00	0.00	7	0.00	0.00	A	8,13
		Dimers	0.00	0.00	7	0.00	0.00	A	8, 13
		Trimers	0.00	0.00	7	0.00	0.00	A	8, 13
		4-6mers	0.00	0.00	4	0.00	0.00	A	13
		7-10mers	0.00	0.00	4	0.00	0.00	A	13
		Polymers	0.00	0.00	4	0.00	0.00	A	13
09070	Cherries, sweet, raw	Monomers	5.11	1.21	7	3.46	6.37	A	8, 13
		Dimers	3.25	0.65	7	2.38	3.91	A	8, 13
		Trimers	2.39	0.51	7	1.85	3.48	A	8, 13
		4-6mers	6.51	0.83	4	5.96	7.74	A	13
		7-10mers	1.87	0.11	4	1.77	2.03	A	13
		Polymers	0.00	0.00	4	0.00	0.00	A	13
16056	Chickpeas (garbanzo beans, bengal gram), mature seeds, raw	Monomers	0.00	0.00	3	0.00	0.00	C	8
		Dimers	0.00	0.00	3	0.00	0.00	C	8
		Trimers	0.00	0.00	3	0.00	0.00	C	8

Table 1. USDA Database for the Proanthocyanidin Content of Selected Foods – 2004

(for mean, standard deviation, min and max, units = mg/100 g, edible portion)

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NDB No.	Description	Proanthocyanidin	Mean ¹	SD	N	Min	Max	CC	Sources of Data
97040	Chocolate, liquor	Monomers	363.33	63.29	12	200.00	490.00	C	1
		Dimers	306.67	51.40	12	180.00	420.00	C	1
		Trimers	210.00	32.19	12	130.00	280.00	C	1
		4-6mers	406.67	63.87	12	240.00	530.00	C	1
		7-10mers	190.00	22.56	12	130.00	230.00	C	1
97012	Choke berries	Monomers	5.20		2	5.20	5.20	B	13
		Dimers	12.50		2	12.50	12.50	B	13
		Trimers	10.30		2	10.30	10.30	B	13
		4-6mers	40.30		2	40.30	40.30	B	13
		7-10mers	52.90		2	52.90	52.90	B	13
		Polymers	542.60		2	542.60	542.60	B	13
97083	Cocoa drink, made with water (Spain)	Monomers	1.33	0.00	3	1.33	1.33	C	8
		Dimers	0.36	0.00	3	0.36	0.36	C	8
		Trimers	0.13	0.00	3	0.13	0.13	C	8
19165	Cocoa, dry powder, unsweetened	Monomers	316.83	466.98	7	26.60	1381.00	C	8, 18
		Dimers	183.49	347.12	7	7.20	991.20	C	8, 18
		Trimers	159.54	256.46	7	2.60	739.00	C	8, 18
		4-6mers	524.53	727.98	4	38.40	1590.30	C	18
		7-10mers	188.93	285.02	4	3.10	606.80	C	18
14209	Coffee, brewed from grounds, prepared with tap water	Monomers	0.11	0.00	3	0.11	0.11	C	8
		Dimers	0.00	0.00	3	0.00	0.00	C	8
		Trimers	0.00	0.00	3	0.00	0.00	C	8
97081	Coffee, ground	Monomers	3.67	0.00	3	3.67	3.67	C	8
		Dimers	0.00	0.00	3	0.00	0.00	C	8
		Trimers	0.00	0.00	3	0.00	0.00	C	8
16062	Cowpeas, common (blackeyes, crowder, southern), mature seeds, raw	Monomers	14.00		2	14.00	14.00	B	13
		Dimers	6.00		2	6.00	6.00	B	13
		Trimers	6.10		2	6.10	6.10	B	13
		4-6mers	7.30		2	7.30	7.30	B	13
		7-10mers	0.00		2	0.00	0.00	B	13
		Polymers	0.00		2	0.00	0.00	B	13
09078	Cranberries, raw	Monomers	7.26	1.51	4	5.53	8.59	A	13
		Dimers	25.93	6.12	4	20.55	33.16	A	13
		Trimers	18.93	3.39	4	14.17	22.16	A	13
		4-6mers	70.27	13.07	4	54.63	84.95	A	13
		7-10mers	62.90	14.71	4	50.09	79.99	A	13
		Polymers	233.48	49.08	4	167.46	276.36	A	13
14242	Cranberry juice cocktail, bottled	Monomers	0.56		2	0.56	0.56	B	13
		Dimers	2.71		2	2.71	2.71	B	13
		Trimers	1.59		2	1.59	1.59	B	13
		4-6mers	4.58		2	4.58	4.58	B	13
		7-10mers	3.84		2	3.84	3.84	B	13

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(for mean, standard deviation, min and max, units = mg/100 g, edible portion)

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NDB No.	Description	Proanthocyanidin	Mean ¹	SD	N	Min	Max	CC	Sources of Data
		Polymers	8.33		2	8.33	8.33	B	13
09083	Currants, european black, raw	Monomers	0.90		2	0.90	0.90	B	13
		Dimers	2.90		2	2.90	2.90	B	13
		Trimers	3.00		2	3.00	3.00	B	13
		4-6mers	10.60		2	10.60	10.60	B	13
		7-10mers	9.90		2	9.90	9.90	B	13
		Polymers	122.40		2	122.40	122.40	B	13
99044	Currants, red	Monomers	3.23	0.00	3	3.23	3.23	C	8
		Dimers	1.90	0.00	3	1.90	1.90	C	8
		Trimers	0.00	0.00	3	0.00	0.00	C	8
09086	Custard-apple, (bullock's-heart), raw	Monomers	6.25	0.00	3	6.25	6.25	C	8
		Dimers	14.20	0.00	3	14.20	14.20	C	8
		Trimers	4.49	0.00	3	4.49	4.49	C	8
09087	Dates, deglet noor	Monomers	0.00	0.00	7	0.00	0.00	A	13
		Dimers	1.84	0.48	7	1.28	2.57	A	13
		Trimers	3.02	0.46	7	2.34	3.67	A	13
		4-6mers	5.88	0.68	7	4.78	6.70	A	13
		7-10mers	0.00	0.00	7	0.00	0.00	A	13
		Polymers	0.00	0.00	7	0.00	0.00	A	13
11209	Eggplant, raw	Monomers	0.00	0.00	3	0.00	0.00	C	8
		Dimers	0.00	0.00	3	0.00	0.00	C	8
		Trimers	0.00	0.00	3	0.00	0.00	C	8
09089	Figs, raw	Monomers	0.03	0.04	11	0.00	0.12	A	8, 13
		Dimers	0.01	0.01	11	0.00	0.03	A	8, 13
		Trimers	0.00	0.00	11	0.00	0.00	A	8, 13
		4-6mers	0.00	0.00	8	0.00	0.00	A	13
		7-10mers	0.00	0.00	8	0.00	0.00	A	13
		Polymers	0.00	0.00	8	0.00	0.00	A	13
09135	Grape juice, purple, canned or bottled, unsweetened, without added vitamin C	Monomers	1.69		2	1.69	1.69	B	13
		Dimers	3.18		2	3.18	3.18	B	13
		Trimers	1.78		2	1.78	1.78	B	13
		4-6mers	7.49		2	7.49	7.49	B	13
		7-10mers	6.46		2	6.46	6.46	B	13
		Polymers	28.37		2	28.37	28.37	B	13
97082	Grape juice, white, canned	Monomers	0.16		1	0.16	0.16	C	26
		Dimers	0.24		1	0.24	0.24	C	26
		Trimers	0.00		1	0.00	0.00	C	26
97003	Grape seeds, raw	Monomers	171.29	80.56	34	44.00	439.00	C	9, 22
		Dimers	169.89	110.51	37	16.00	539.00	C	9, 22
		Trimers	32.22	30.63	37	0.00	138.00	C	9, 22
97004	Grape skins, raw	Dimers	33.87	7.15	3	28.60	42.00	C	22
		Trimers	14.10	3.85	3	10.30	18.00	C	22

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(for mean, standard deviation, min and max, units = mg/100 g, edible portion)

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NDB No.	Description	Proanthocyanidin	Mean ¹	SD	N	Min	Max	CC	Sources of Data
97073	Grapes, green, raw	Monomers	0.96	0.09	4	0.87	1.06	A	13
		Dimers	2.33	0.05	4	2.26	2.36	A	13
		Trimers	1.88	0.06	4	1.79	1.93	A	13
		4-6mers	8.35	0.33	4	8.01	8.68	A	13
		7-10mers	9.15	0.59	4	8.64	9.90	A	13
		Polymers	58.87	14.17	4	46.21	79.18	A	13
97074	Grapes, red, raw	Monomers	1.36	0.56	9	0.44	2.14	B	8, 13, 20
		Dimers	2.38	1.40	9	1.24	5.26	B	8, 13, 20
		Trimers	1.01	0.48	7	0.38	1.64	A	8, 13
		4-6mers	6.07	0.88	4	4.87	7.00	A	13
		7-10mers	6.23	1.10	4	4.77	7.44	A	13
		Polymers	44.56	9.89	4	32.88	54.31	A	13
97014	Hops	Monomers	157.53	87.94	4	81.70	282.10	C	14
		Dimers	84.10	44.82	4	42.80	147.20	C	14
		Trimers	51.53	25.32	4	28.70	87.50	C	14
35138	Indian Squash, Raw (Navajo)	Monomers	1.63		1	1.63	1.63	B	13
		Dimers	1.98		1	1.98	1.98	B	13
		Trimers	1.49		1	1.49	1.49	B	13
		4-6mers	4.62		1	4.62	4.62	B	13
		7-10mers	3.19		1	3.19	3.19	B	13
		Polymers	3.50		1	3.50	3.50	B	13
09148	Kiwi fruit, (chinese gooseberries), fresh, raw	Monomers	0.51	0.42	11	0.19	1.28	A	8, 13
		Dimers	0.61	0.22	11	0.14	0.87	A	8, 13
		Trimers	0.52	0.19	11	0.11	0.77	A	8, 13
		4-6mers	1.32	0.94	8	0.00	2.43	A	13
		7-10mers	0.20	0.27	8	0.00	0.54	A	13
		Polymers	0.00	0.00	8	0.00	0.00	A	13
97079	Kiwi, gold, raw	Monomers	1.10		1	1.10	1.10	B	13
		Dimers	1.61		1	1.61	1.61	B	13
		Trimers	1.16		1	1.16	1.16	B	13
		4-6mers	5.00		1	5.00	5.00	B	13
		7-10mers	5.03		1	5.03	5.03	B	13
		Polymers	0.00		1	0.00	0.00	B	13
16069	Lentils, mature seeds, raw	Monomers	0.53	0.07	4	0.49	0.65	C	4, 8
		Dimers	1.20	0.29	4	1.04	1.67	C	4, 8
		Trimers	0.11	0.20	4	0.00	0.44	C	4, 8
11248	Lentils, sprouted, raw	Monomers	0.00		1	0.00	0.00	D	4
		Dimers	1.86		1	1.86	1.86	D	4
		Trimers	0.00		1	0.00	0.00	D	4
14317	Malted drink mix, chocolate, powder	Monomers	35.90	32.50	3	15.90	73.40	C	18
		Dimers	20.60	11.59	3	11.70	33.70	C	18
		Trimers	8.77	5.24	3	5.40	14.80	C	18

Table 1. USDA Database for the Proanthocyanidin Content of Selected Foods – 2004

(for mean, standard deviation, min and max, units = mg/100 g, edible portion)

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NDB No.	Description	Proanthocyanidin	Mean ¹	SD	N	Min	Max	CC	Sources of Data
		4-6mers	12.10	9.66	3	5.60	23.20	C	18
		7-10mers	0.77	0.68	3	0.00	1.30	C	18
09176	Mangos, raw	Monomers	2.30		1	2.30	2.30	B	13
		Dimers	1.80		1	1.80	1.80	B	13
		Trimers	1.40		1	1.40	1.40	B	13
		4-6mers	7.20		1	7.20	7.20	B	13
		7-10mers	0.00		1	0.00	0.00	B	13
		Polymers	0.00		1	0.00	0.00	B	13
97011	Marionberries (Northwest blackberries), raw	Monomers	0.90		2	0.90	0.90	B	13
		Dimers	3.40		2	3.40	3.40	B	13
		Trimers	2.40		2	2.40	2.40	B	13
		4-6mers	2.20		2	2.20	2.20	B	13
		7-10mers	0.00		2	0.00	0.00	B	13
		Polymers	0.00		2	0.00	0.00	B	13
97086	Medlar, raw	Monomers	0.79	0.00	3	0.79	0.79	C	8
		Dimers	1.30	0.00	3	1.30	1.30	C	8
		Trimers	0.63	0.00	3	0.63	0.63	C	8
01102	Milk, chocolate, fluid, commercial	Monomers	0.40		2	0.31	0.49	A	13
		Dimers	2.18		2	2.15	2.21	A	13
		Trimers	0.00		2	0.00	0.00	A	13
		4-6mers	0.00		2	0.00	0.00	A	13
		7-10mers	0.00		2	0.00	0.00	A	13
		Polymers	0.00		2	0.00	0.00	A	13
09191	Nectarines, with peel, raw	Monomers	5.57	2.49	38	0.39	12.53	B	13, 30
		Dimers	5.00	3.83	38	0.12	23.52	B	13, 30
		Trimers	1.75	0.80	8	0.68	2.92	A	13
		4-6mers	5.98	2.96	8	2.15	10.17	A	13
		7-10mers	3.57	2.27	8	0.00	6.89	A	13
		Polymers	7.31	6.71	8	0.00	19.08	A	13
97049	Nectarines, white, with peel, raw	Monomers	10.64	4.69	30	2.39	29.67	C	30
		Dimers	11.93	8.28	30	0.13	39.91	C	30
12061	Nuts, almonds	Monomers	7.77	0.86	8	6.84	8.92	A	13
		Dimers	9.52	1.64	8	6.60	11.86	A	13
		Trimers	8.82	1.67	8	6.62	11.05	A	13
		4-6mers	39.97	8.49	8	29.36	51.36	A	13
		7-10mers	37.68	8.37	8	27.18	51.98	A	13
		Polymers	80.26	28.09	8	43.86	120.94	A	13
12087	Nuts, cashew nuts, raw	Monomers	6.66	2.88	7	3.36	10.80	A	13
		Dimers	2.02	0.42	7	1.49	2.55	A	13
		Trimers	0.00	0.00	7	0.00	0.00	A	13
		4-6mers	0.00	0.00	7	0.00	0.00	A	13
		7-10mers	0.00	0.00	7	0.00	0.00	A	13

Table 1. USDA Database for the Proanthocyanidin Content of Selected Foods – 2004

(for mean, standard deviation, min and max, units = mg/100 g, edible portion)

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NDB No.	Description	Proanthocyanidin	Mean ¹	SD	N	Min	Max	CC	Sources of Data
		Polymers	0.00	0.00	7	0.00	0.00	A	13
12099	Nuts, chestnuts, european, dried, unpeeled	Monomers	0.02	0.00	3	0.02	0.02	C	8
		Dimers	0.01	0.00	3	0.01	0.01	C	8
		Trimers	0.02	0.00	3	0.02	0.02	C	8
		Polymers	0.02	0.00	3	0.02	0.02	C	8
12120	Nuts, hazelnuts or filberts	Monomers	9.83	1.57	8	6.77	12.10	A	13
		Dimers	12.51	3.84	8	4.43	17.73	A	13
		Trimers	13.56	3.93	8	4.93	17.09	A	13
		4-6mers	67.72	20.34	8	22.78	85.57	A	13
		7-10mers	74.60	21.90	8	26.06	102.69	A	13
		Polymers	322.44	102.48	8	98.10	442.95	A	13
12142	Nuts, pecans	Monomers	17.22	2.55	8	12.60	19.98	A	13
		Dimers	42.13	5.42	8	33.74	49.46	A	13
		Trimers	26.03	1.98	8	22.82	28.77	A	13
		4-6mers	101.43	10.45	8	87.44	119.79	A	13
		7-10mers	84.23	12.90	8	65.00	99.54	A	13
		Polymers	223.01	59.05	8	140.58	297.31	A	13
12151	Nuts, pistachio nuts, raw	Monomers	10.94	4.35	7	5.89	15.77	A	13
		Dimers	13.26	1.80	7	10.11	15.10	A	13
		Trimers	10.51	1.22	7	8.49	12.00	A	13
		4-6mers	42.24	5.23	7	32.33	47.26	A	13
		7-10mers	37.93	4.93	7	28.36	43.28	A	13
		Polymers	122.46	37.10	7	53.25	158.74	A	13
12155	Nuts, walnuts, english	Monomers	6.93	3.39	8	2.88	11.50	A	13
		Dimers	5.65	0.89	8	4.02	6.63	A	13
		Trimers	7.19	1.16	8	5.04	8.49	A	13
		4-6mers	22.05	3.31	8	16.64	26.14	A	13
		7-10mers	5.41	0.81	8	4.20	6.54	A	13
		Polymers	20.02	9.27	8	5.34	39.43	A	13
97087	Peaches, canned, heavy syrup pack, drained liquid	Monomers	0.55		2	0.45	0.65	A	13
		Dimers	2.81		2	2.80	2.83	A	13
		Trimers	0.00		2	0.00	0.00	A	13
		4-6mers	0.00		2	0.00	0.00	A	13
		7-10mers	0.00		2	0.00	0.00	A	13
		Polymers	0.00		2	0.00	0.00	A	13
09370	Peaches, canned, heavy syrup, drained	Monomers	0.62		2	0.52	0.72	A	13
		Dimers	1.82		2	1.76	1.88	A	13
		Trimers	0.00		2	0.00	0.00	A	13
		4-6mers	0.00		2	0.00	0.00	A	13
		7-10mers	0.00		2	0.00	0.00	A	13
		Polymers	0.00		2	0.00	0.00	A	13
97054	Peaches, white, with peel, raw	Monomers	6.31	1.51	30	2.77	12.30	C	30
		Dimers	23.45	9.44	30	4.76	49.57	C	30

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(for mean, standard deviation, min and max, units = mg/100 g, edible portion)

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NDB No.	Description	Proanthocyanidin	Mean ¹	SD	N	Min	Max	CC	Sources of Data
09236	Peaches, yellow, with peel, raw	Monomers	4.48	1.32	41	1.19	8.39	B	8, 13, 30
		Dimers	12.24	4.44	41	4.12	25.20	B	8, 13, 30
		Trimers	4.41	1.40	11	2.74	6.94	A	8, 13
		4-6mers	17.66	5.45	8	9.58	26.25	A	13
		7-10mers	10.94	3.72	8	5.71	17.10	A	13
		Polymers	22.02	7.73	8	12.74	34.54	A	13
16098	Peanut butter, smooth style, with salt	Monomers	2.03	0.93	3	0.99	2.79	A	13
		Dimers	3.00	0.76	3	2.12	3.50	A	13
		Trimers	8.14	3.49	3	4.14	10.59	A	13
		4-6mers	0.00	0.00	3	0.00	0.00	A	13
		7-10mers	0.00	0.00	3	0.00	0.00	A	13
		Polymers	0.00	0.00	3	0.00	0.00	A	13
16089	Peanuts, all types, oil-roasted, with salt	Monomers	5.11	1.00	4	3.74	5.88	A	13
		Dimers	4.07	0.70	4	3.12	4.72	A	13
		Trimers	3.67	0.46	4	3.20	4.20	A	13
		4-6mers	2.77	0.20	4	2.57	2.97	A	13
		7-10mers	0.00	0.00	4	0.00	0.00	A	13
		Polymers	0.00	0.00	4	0.00	0.00	A	13
97016	Pear juice, all varieties	Monomers	0.00	0.00	3	0.00	0.00	C	25
		Dimers	0.00	0.00	3	0.00	0.00	C	25
		Trimers	0.00	0.00	3	0.00	0.00	C	25
97075	Pears, green cultivars, with peel, raw	Monomers	2.03	0.29	7	1.71	2.49	A	13
		Dimers	2.73	0.44	7	2.11	3.49	A	13
		Trimers	2.03	0.31	7	1.59	2.61	A	13
		4-6mers	5.99	1.13	7	4.25	7.97	A	13
		7-10mers	5.36	1.39	7	3.64	8.02	A	13
		Polymers	24.16	15.28	7	10.00	56.33	A	13
97076	Pears, red anjou, with peel, raw	Monomers	2.67	1.46	4	0.93	4.21	A	13
		Dimers	2.81	1.25	4	1.55	4.33	A	13
		Trimers	2.29	0.92	4	1.37	3.36	A	13
		4-6mers	6.47	1.87	4	4.66	8.96	A	13
		7-10mers	4.57	0.97	4	3.68	5.91	A	13
		Polymers	13.11	11.30	4	0.97	23.32	A	13
16085	Peas, split, mature seeds, raw	Monomers	0.02	0.00	3	0.02	0.02	C	8
		Dimers	0.00	0.00	3	0.00	0.00	C	8
		Trimers	0.00	0.00	3	0.00	0.00	C	8
11334	Peppers, sweet, green, cooked, boiled, drained, without salt	Monomers	0.00	0.00	4	0.00	0.00	A	13
		Dimers	0.00	0.00	4	0.00	0.00	A	13
		Trimers	0.00	0.00	4	0.00	0.00	A	13
		4-6mers	0.00	0.00	4	0.00	0.00	A	13
		7-10mers	0.00	0.00	4	0.00	0.00	A	13
		Polymers	0.00	0.00	4	0.00	0.00	A	13

Table 1. USDA Database for the Proanthocyanidin Content of Selected Foods – 2004

(for mean, standard deviation, min and max, units = mg/100 g, edible portion)

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NDB No.	Description	Proanthocyanidin	Mean ¹	SD	N	Min	Max	CC	Sources of Data
11333	Peppers, sweet, green, raw	Monomers	0.00	0.00	7	0.00	0.00	A	8, 13
		Dimers	0.00	0.00	7	0.00	0.00	A	8, 13
		Trimers	0.00	0.00	7	0.00	0.00	A	8, 13
		4-6mers	0.00	0.00	4	0.00	0.00	A	13
		7-10mers	0.00	0.00	4	0.00	0.00	A	13
		Polymers	0.00	0.00	4	0.00	0.00	A	13
11823	Peppers, sweet, red, cooked, boiled, drained, without salt	Monomers	0.00	0.00	4	0.00	0.00	A	13
		Dimers	0.00	0.00	4	0.00	0.00	A	13
		Trimers	0.00	0.00	4	0.00	0.00	A	13
		4-6mers	0.00	0.00	4	0.00	0.00	A	13
		7-10mers	0.00	0.00	4	0.00	0.00	A	13
		Polymers	0.00	0.00	4	0.00	0.00	A	13
11821	Peppers, sweet, red, raw	Monomers	0.00	0.00	7	0.00	0.00	A	8, 13
		Dimers	0.00	0.00	7	0.00	0.00	A	8, 13
		Trimers	0.00	0.00	7	0.00	0.00	A	8, 13
		4-6mers	0.00	0.00	4	0.00	0.00	A	13
		7-10mers	0.00	0.00	4	0.00	0.00	A	13
		Polymers	0.00	0.00	4	0.00	0.00	A	13
97088	Persimmons, raw	Monomers	0.80	0.00	3	0.80	0.80	C	8
		Dimers	0.44	0.00	3	0.44	0.44	C	8
		Trimers	0.04	0.00	3	0.04	0.04	C	8
09266	Pineapple, raw, all varieties	Monomers	0.00	0.00	6	0.00	0.00	B	8, 13
		Dimers	0.00	0.00	6	0.00	0.00	B	8, 13
		Trimers	0.00	0.00	6	0.00	0.00	B	8, 13
		4-6mers	0.00	0.00	3	0.00	0.00	A	13
		7-10mers	0.00	0.00	3	0.00	0.00	A	13
		Polymers	0.00	0.00	3	0.00	0.00	A	13
09430	Pineapple, raw, extra sweet variety	Monomers	0.00	0.00	7	0.00	0.00	A	13
		Dimers	0.00	0.00	7	0.00	0.00	A	13
		Trimers	0.00	0.00	7	0.00	0.00	A	13
		4-6mers	0.00	0.00	7	0.00	0.00	A	13
		7-10mers	0.00	0.00	7	0.00	0.00	A	13
		Polymers	0.00	0.00	7	0.00	0.00	A	13
97046	Plum, yellow, whole, raw	Dimers	27.71	1.04	6	26.06	29.36	C	30
97077	Plums, black diamond, with peel, raw	Monomers	8.36		2	6.79	9.93	B	13
		Dimers	19.74		2	16.04	23.44	B	13
		Trimers	18.84		2	14.91	22.76	B	13
		4-6mers	57.33		2	49.91	64.74	B	13
		7-10mers	38.04		2	34.89	41.18	B	13
		Polymers	104.96		2	94.58	115.34	B	13
09279	Plums, with peel, raw	Monomers	10.88	2.91	11	6.38	14.94	A	13, 30
		Dimers	38.54	10.72	35	18.14	74.02	B	8, 13, 30

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NDB No.	Description	Proanthocyanidin	Mean ¹	SD	N	Min	Max	CC	Sources of Data
		Trimers	22.25	4.76	11	14.54	31.16	A	13, 30
		4-6mers	58.04	12.52	8	39.31	75.70	A	13
		7-10mers	33.79	11.87	8	15.26	54.48	A	13
		Polymers	57.28	24.41	8	18.37	98.71	A	13
09286	Pomegranates, raw	Monomers	0.81	0.00	3	0.81	0.81	C	8
		Dimers	0.29	0.00	3	0.29	0.29	C	8
		Trimers	0.00	0.00	3	0.00	0.00	C	8
09296	Quinces, raw	Monomers	1.42	0.00	3	1.42	1.42	C	8
		Dimers	2.61	0.00	3	2.61	2.61	C	8
		Trimers	1.22	0.00	3	1.22	1.22	C	8
09302	Raspberries, raw	Monomers	3.91	2.74	9	1.12	9.49	A	8, 13
		Dimers	8.64	8.36	9	2.34	25.58	A	8, 13
		Trimers	3.92	4.83	9	0.30	13.92	A	8, 13
		4-6mers	7.70	5.18	6	2.83	15.21	A	13
		7-10mers	0.90	1.73	6	0.00	4.39	A	13
		Polymers	0.00	0.00	6	0.00	0.00	A	13
20067	Sorghum, grain	Monomers	9.09	6.19	8	0.90	18.00	B	2, 13
		Dimers	22.10	10.56	8	8.00	36.72	B	2, 13
		Trimers	28.43	13.44	8	10.30	46.82	B	2, 13
		4-6mers	157.37	53.54	8	85.10	232.25	B	2, 13
		7-10mers	223.40	53.28	8	150.00	298.35	B	2, 13
		Polymers	1461.99	93.00	8	1307.30	1622.11	B	2, 13
97030	Sorghum, bran	Monomers	23.24	4.20	5	27.80	30.29	B	2, 12, 13
		Dimers	95.56	18.32	5	77.19	122.09	B	2, 12, 13
		Trimers	123.72	17.19	5	99.20	147.80	B	2, 12, 13
		4-6mers	650.32	92.09	5	531.03	774.79	B	2, 12, 13
		7-10mers	784.19	101.42	5	625.89	904.23	B	2, 12, 13
		Polymers	2927.64	335.38	5	2440.40	3384.67	B	2, 12, 13
02010	Spices, cinnamon, ground	Monomers	23.92		1	23.92	23.92	B	13
		Dimers	256.29		1	256.29	256.29	B	13
		Trimers	1252.20		1	1252.20	1252.20	B	13
		4-6mers	2608.63		1	2608.63	2608.63	B	13
		7-10mers	1458.32		1	1458.32	1458.32	B	13
		Polymers	2508.78		1	2508.78	2508.78	B	13
02015	Spices, curry powder	Monomers	0.00		1	0.00	0.00	B	13
		Dimers	9.50		1	9.50	9.50	B	13
		Trimers	22.88		1	22.88	22.88	B	13
		4-6mers	41.78		1	41.78	41.78	B	13
		7-10mers	0.00		1	0.00	0.00	B	13
		Polymers	0.00		1	0.00	0.00	B	13
11953	Squash, zucchini, baby, raw	Monomers	0.00	0.00	3	0.00	0.00	C	8
		Dimers	0.00	0.00	3	0.00	0.00	C	8
		Trimers	0.00	0.00	3	0.00	0.00	C	8

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NDB No.	Description	Proanthocyanidin	Mean ¹	SD	N	Min	Max	CC	Sources of Data
09316	Strawberries, raw	Monomers	3.71	0.80	11	2.52	5.47	A	8, 13
		Dimers	5.26	1.89	11	1.89	8.61	A	8, 13
		Trimers	4.90	2.27	11	0.50	8.57	A	8, 13
		4-6mers	28.14	6.47	8	18.77	38.95	A	13
		7-10mers	23.88	3.47	8	18.38	28.84	A	13
		Polymers	75.78	13.36	8	57.83	97.81	A	13
97007	Strawberry tree fruit (arbutus), raw	Monomers	10.19	0.00	3	10.19	10.19	C	8
		Dimers	6.60	0.00	3	6.60	6.60	C	8
		Trimers	3.69	0.00	3	3.69	3.69	C	8
14355	Tea, brewed, prepared with tap water	Monomers	9.30	0.00	3	9.30	9.30	C	8
		Dimers	3.74	0.00	3	3.74	3.74	C	8
		Trimers	0.38	0.00	3	0.38	0.38	C	8
11529	Tomatoes, red, ripe, raw, year round average	Monomers	0.00	0.00	3	0.00	0.00	A	8
		Dimers	0.00	0.00	3	0.00	0.00	A	8
		Trimers	0.00	0.00	3	0.00	0.00	A	8
20080	Wheat flour, whole-grain	Monomers	0.00	0.00	3	0.00	0.00	C	8
		Dimers	0.00	0.00	3	0.00	0.00	C	8
		Trimers	0.00	0.00	3	0.00	0.00	C	8
97002	Wine, sherry white	Monomers	3.62	0.00	3	3.62	3.62	C	3
		Dimers	4.56	0.00	3	4.56	4.56	C	3

Table 2. Foods Containing Undetectable Amounts of Proanthocyanidins¹

NDB_No	Food Description	NDB_No	Food Description
97091	Agave, cooked		salt
97092	Agave, dried	11282	Onions, raw
97090	Agave, raw	11294	Onions, sweet, raw
11008	Artichokes, (globe or french), cooked, boiled, drained, without salt	09202	Oranges, raw, navels
11012	Asparagus, cooked, boiled, drained	09291	Plums, dried (prunes), uncooked
35132	Banana Melon (Navajo)	11358	Potatoes, red, flesh and skin, baked
16037	Beans, navy, raw	11355	Potatoes, red, flesh and skin, raw
35131	Blue Corn Meal (Navajo)	11356	Potatoes, Russet, flesh and skin, baked
35130	Blue Corn Meal with ash (Navajo)	11353	Potatoes, russet, flesh and skin, raw
11097	Broccoli raab, cooked	11357	Potatoes, white, flesh and skin, baked
11096	Broccoli raab, raw	11354	Potatoes, white, flesh and skin, raw
11091	Broccoli, cooked, boiled, drained, without salt	11429	Radishes, raw
11090	Broccoli, raw	09298	Raisins, seedless
11110	Cabbage, cooked, boiled, drained, without salt	20044	Rice, white, long-grain, regular, raw, enriched
11113	Cabbage, red, cooked, boiled, drained, without salt	97089	Snacks, tortilla chips, low fat, made with olestra
11112	Cabbage, red, raw	19444	Snacks, tortilla chips, low fat, made with olestra, nacho cheese
11960	Carrots, baby, raw	16108	Soybeans, mature seeds, raw
11143	Celery, raw	02003	Spices, basil, dried
11206	Cucumber, peeled, raw	02009	Spices, chili powder
11205	Cucumber, with peel, raw	02011	Spices, cloves, ground
09421	Dates, medjool	02020	Spices, garlic powder
09112	Grapefruit, raw, pink and red, all areas	02021	Spices, ginger, ground
11250	Lettuce, butterhead (includes boston and bibb types), raw	02024	Spices, mustard seed, yellow
11251	Lettuce, cos or romaine, raw	02026	Spices, onion powder
11253	Lettuce, green leaf, raw	02027	Spices, oregano, dried
11252	Lettuce, iceberg (includes crisphead types), raw	02028	Spices, paprika
11257	Lettuce, red leaf, raw	02029	Spices, parsley, dried
09159	Limes, raw	02030	Spices, pepper, black
09181	Melons, cantaloupe, raw	02033	Spices, poppy seed
09184	Melons, honeydew, raw	02043	Spices, turmeric, ground
12078	Nuts, brazilnuts, dried, unblanched	11508	Sweetpotato, cooked, baked in skin, without salt
12132	Nuts, macadamia nuts, dry roasted, without salt added	11510	Sweetpotato, cooked, boiled, without skin
12147	Nuts, pine nuts, pignolia, dried	11507	Sweetpotato, raw, unprepared
20038	Oats	09218	Tangerines, (mandarin oranges), raw
11283	Onions, cooked, boiled, drained, without	11530	Tomatoes, red, ripe, cooked
		09326	Watermelon, raw

¹ From Gu, et al (2003) J. Agric. Food Chem. 51:7513-7521.

Table 3. Foods containing prodelphinidins, propelargonidins and A-Type Linkages in addition to Procyanidins and B-Type linkages

Fruits	Prodelphinidins¹	Propelargonidins¹	A-Type Linkages¹
Avocado			√ (13)
Bananas	√ (8)		
Blackberries	√ (8)		
Cranberries			√ (13)
Currants, black	√ (13)		
Currants, red	√ (8)		
Grapes, green	√ (8, 13)		
Grapes, red	√ (13)		
Persimmons	√ (8)		
Plums			√ (13, 30)
Quince	√ (8)		
Raspberry		√ (13)	
Strawberry		√ (13)	
Strawberry tree fruit	√ (8)		
Vegetables			
Broad beans	√ (8)		
Nuts			
Almonds		√ (13)	
Hazelnuts	√ (13)		
Peanuts, roasted; Peanut butter			√ (13)
Pecans	√ (13)		
Pistachios	√ (13)		
Beverages			
Beer	√ (8, 13, 16, 19)		
Cranberry juice cocktail			√ (13)
Grape Juice	√ (13)		
Tea, Black and green	√ (8)		
Wine, red	√ (8, 13)		
Grains			
Barley	√ (14, 16)		
Lentil	√ (8)		
Pinto beans		√ (13)	
Red beans, small		√ (13)	
Red kidney beans		√ (13)	
Spices			
Cinnamon		√ (13)	√ (13)
Curry powder			√ (13)

¹ Reference number to source of data in parentheses

Sources of Data:

1. Adamson, G.E., Lazarus, S.A., Mitchell, A.E., Prior, R.L., Cao, G., Jacobs, P.H., Kremers, B.G., Hammerstone, J.F., Rucker, R.B., Ritter, K.A., and Schmitz, H.H.
HPLC method for the quantification of procyanidins in cocoa and chocolate samples and correlation to total antioxidant capacity.

J. Agric. Food Chem., 1999, 47, 4184-4188.

*Cocoa beans and chocolates (milk, dark, and noir-type).

*Procyanidins (monomers, dimers, trimers, etc.).

2. Awika, J.M., Dykes, L., Gu, L., Rooney, L.W., and Prior, R.L.

Processing sorghum (*Sorghum bicolor*) and sorghum products alters procyanidin oligomer and polymer distribution and content.

J. Agric. Food Chem., 2003, 51(18), 5516-5521.

*Sorghum grain (high tannin, sumac), Sorghum bran (sumac), Cocoa, Blueberry.

*Procyanidins (monomers-decamers, polymers, total procyanidins).

3. Baron, R., Mayen, M., Merida, J., and Medina, M.

Changes in phenolic compounds and browning during biological aging of sherry-type wine.

J. Agric. Food Chem., 1997, 45(5), 1682-1685.

*Dry pale sherry white wine (in 5 different stages of aging).

*Procyanidins B1-B4, Catechin, Epicatechin, Phenolic acids (Gallic, Protocatechuic, Vanillic, Syringic, Caffeic, *p*-Coumaric, Ferulic, Tyrosol, *trans*-Cafataric, *cis*-Coutaric, *trans*-Coutaric, Fefataric).

4. Bartolome, B., Estrella, I., and Hernandez, T.

Changes in phenolic compounds in lentils (*Lens culinaris*) during germination and fermentation.

Z. Lebensm Unters Forsch A., 1997, 205, 290-294.

*Lentils (*Lens culinaris*): raw, germinated, and fermented

*Procyanidins B1-B3, B5, C1 (trimers), T2-T4 (tetramers), (+)-Catechin, Phenolic acids (Protocatechuic-acid & aldehyde, Gentisic acid, *p*-Hydroxybenzoic-acid & aldehyde, Vanillic, *p*-Hydroxyphenylpropionic, *p*-Coumaric, Ferulic), Vanillin, Tryptophol.

5. Betes-Saura, C., Andres-Lacueva, C., and Lamuela-Raventos, R.M.

Phenolics in white free run juices and wines from Penedes by high-performance liquid chromatography: Changes during vinification.

J. Agric. Food Chem., 1996, 44(10), 3040-3046.

*White free run grape juice & wines (from Penedes).

*Procyanidins B2 & B3, Phenolic acids, Benzoic acids, Hydroxycinnamics, Totals.

6. Burda, S., Oleszek, W., and Lee, C.Y.

Phenolic compounds and their changes in apples during maturation and cold storage.

J. Agric. Food Chem., 1990, 38, 945-948.

*Apples (Golden delicious, Empire, Rhode Island Greening).

*Procyanidin B2, Epicatechin, Quercetin glycosides, Phloretin xylogalactoside, Phloretin glucoside, Chlorogenic acid.

7. de Freitas, V.A.P., Glories, Y., and Monique, A.

Developmental changes of procyanidins in grapes of red *Vitis vinifera* varieties and their composition in respective wines.

Am. J. Enol. Vitic., 2000, 51(4), 397-403.

*Wine-Merlot and Cabernet Sauvignon.

*Procyanidins dimers: B1-B8, Trimer C1, Total dimers + C1, Total dimers + catechins, (+)-Catechin, (-)-Epicatechin, (-)-Epicatechin gallate.

8. de Pascual-Teresa, S., Santos-Buelga, C., and Rivas-Gonzalo, J.C.

Quantitative analysis of flavan-3-ols in Spanish foodstuffs and beverages.

J. Agric. Food Chem., 2000, 48, 5331-5337.

*Apple (Golden), Apple (Granny Smith), Apple Renette, Apple (Red Delicious), Apricot, Avocado, Banana, Blackberry, Blueberry, Cherry, Chestnut, Custard apple, Early fig, Grape (red), Grape (white), Kiwi, Medlar, Peach, Pear (Blanquilla), Pear (Conferencia), Persimmon, Pineapple, Plum, Pomegranate, Quince, Raspberry, Redcurrent, Strawberry, Strawberry tree fruit, Aubergine, Broad bean, Carrot, Courgette, Lettuce, Onion, Pea, Pepper (red), Pepper (green), Tomato, Chickpea, French bean, Lentil, Pinto bean, White bean, Cider, Coffee, Soluble cacao, Tea (black), Tea (green), Wine (red), Wine (rose), Wine (white), Beer, Bee pollen, Chocolate, Wheat flour.

*Procyanidins B1-B5, B7, C1, Gallocatechin, Catechin, Epigallocatechin, Epicatechin, Epigallocatechin gallate, Epicatechin-3O-gallate.

9. Fuleki, T., and Ricardo da Silva, J.M.

Catechin and procyanidin composition of seeds from grape cultivars grown in Ontario.

J. Agric. Food Chem., 1997, 45, 1156-1160.

*Grape seeds.

***(+)-Catechin, (-)-Epicatechin, procyanidin dimmers, trimers.**

10. Ghiselli, A., Nardini, M., Baldi, A., and Scaccini, C.

Antioxidant activity of different phenolic fractions separated from an Italian red wine.

J. Agric. Food Chem., 1998, 46(2), 361-367.

*Italian red wine.

*Procyanidins B1, B2, B3, B6, Free anthocyanins (Delphinidin, Cyanidin, Petunidin, & Malvidin glucosides), Flavonols (Quercetin, Myricetin, & Kaempferol glucosides), Hydroxycinnamoyltartaric acids, Phenolic acids.

11. Gomez-Plaza, E., Gil-Munoz, R., Lopez-Roca, J.M., and Martinez, A.

Color and phenolic compounds of a young red wine as discriminating variables of its aging status.

Food Res. Internat., 1999, 32, 503-507.

*Red wine (var. Monastrell).

*Procyanidins B2, B4, B5, Caftaric acid, Coumaric acid, Catechin, Epicatechin, Anthocyanins (as malvidin-3-glucoside)-Delphinidin, Petunidin, Peonidin, Malvidin.

12. Gu, L., Kelm, M., Hammerstone, J.F., Beecher, G., Cunningham, D., Vannozzi, S., and Prior, R.L.

Fractionation of polymeric procyanidins from lowbush blueberry and quantification of procyanidins in selected foods with an optimized normal-phase HPLC-MS fluorescent detection method.

J. Agric. Food Chem., 2002, 50, 4852-4860.

*Blueberries (lowbush), Brown sorghum bran, Cocoa, Cranberries.

*Procyanidins (monomers through polymers), Total procyanidins.

13. Gu, L., Kelm, M.A., Hammerstone, J.F., Beecher, G., Holden, J., Haytowitz, D., Gebhardt, S., and Prior, R.L.

Concentrations of proanthocyanidins in common foods and estimations of normal consumption.

J. Nutr., 2004, 134(3), 613-617.

14. Jerumanis, J.

Quantitative analysis of flavanoids in barley, hops, and beer by high-performance liquid chromatography (HPLC).

J. Inst. Brew., July-August 1985, 91, 250-252.

*Barley, Hops.

*Procyanidins B3 & C2, Prodelphinidin B3 & trimers (B, D, & E), (+)-Catechin.

15. Kovac, V., Alonso, E., Bourzeix, M., and Revilla, E.

Effect of several enological practices on the content of catechins and proanthocyanidins of red wines.

J. Agric. Food Chem., 1992, 40(10), 1953-1957.

*Red wines (cv Vranac).

*Procyanidins B1-B4, C1, (+)-Catechin, (-)-Epicatechin, Total catechins and procyanidins.

16. Madigan D. and McMurrough I.

Determination of proanthocyanidins and catechins in beer and barley by high-performance liquid chromatography with dual-electrode electrochemical detection.

Analyst, 1994, 194(5), 863-868.

*Beer (stabilized).

*prodelphinidin B3, Procyanidin B3, (+)-Catechin, (-)-Epicatechin.

17. Mangas, J.J., Suarez, B., Picinelli, A., Moreno, J., and Blanco, D.

Differentiation by phenolic profile of apple juices prepared according to two membrane techniques.

J. Agric. Food Chem., 1997, 45(12), 4777-4784.

*Apple juice (from cider apples).

*Procyanidins B1 & B2, (-)-Epicatechin, Chlorogenic acid, Phloretin glucoside (phloridzin), Phloretin xyloglucoside, Unknown polyphenol.

18. Masterfoods, Inc., Hackettstown, New Jersey. Unpublished Data.

*Dark Chocolates, Cocoa powders

*Procyanidins –monomers to dimmers.

19. McMurrough, I. and Madigan, D.

Semipreparative chromatographic procedure for the isolation of dimeric and trimeric proanthocyanidins from barley.

J. Agric. Food Chem., 1996, 44(7), 1731-1735.

*Beer.

*Procyanidins B3 & T4, Prodelphinidins B3, T1-T3, Total dimers and trimers, (+)-Catechin, (-)-Epicatechin, Total monomers, Total flavonols.

20. Oszmianski, J. and Lee, Y.

Isolation and HPLC determination of phenolic compounds in red grapes.

Am. J. Enol. Vitic., 1990, 41(3), 204-206.

*Red grapes (Concord & de Chaunac).

*Procyanidin B3, Epicatechin, Rutin, Quercetin galactoside and glucoside, *trans*-Caffeoyl, *cis*-Caffeoyl, *trans*-Coumaroyl, *cis*-Coumaroyl.

21. Quettier-Deleu, C., Gressier, B., Vasseur, J., Dine, T., Brunet, C., Luyckx, M., Cazin, M., Cazin, J.-C., Bailleul, F., and Trotin, F.

Phenolic compounds and antioxidant activities of buckwheat (*Fagopyrum esculentum* Moench) hulls and flour.

Journal of Ethnopharmacology, 2000, 72, 35-42.

*Flour, Hulls (var. 'La Harpe')

*Procyanidin B2 & B2-3-O-gallate, (-)-Epicatechin, (-)-Epicatechin gallate, Rutin, Quercetin, Hyperoside.

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Dimer and trimer procyanidins in Carignan and Mourvedre grapes and red wines.

Vitis, 1992, 31, 55-63.

*Grapes & Wine-red (Carignan and Mourvedre).

*Procyanidins B1-B4, C1, T2, B1-3-O-gallate, B2-3-O-gallate, B2-3'-O-gallate.

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Effect of pomace contact, carbonic maceration, and hyperoxidation on the procyanidin composition of Grenache blanc wines.

Am. J. Enol. Vitic., 1993, 44(2), 168-172.

*Wine (from Grenache blanc grapes).

*Procyanidins B1-B4, C1, T2, B1-3-O-gallate, B2-3-O-gallate, B2-3'-O-gallate.

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Determination of phenolic acids and flavonoids of apple and pear by high-performance liquid chromatography.

J. Chrom. A., 2001, 910, 265-273.

*Apple and pear juice (apple juice from Jonagold & Elstar varieties; pear juice from Alexander Lucas, Anjou, & Red Williams varieties).

*Procyanidins B1 & B2, Catechin, Epicatechin, Quercetin & Quercetin glycosides, 5-HMF, *p*-Coumaroyl glucose, Chlorogenic acid, *p*-Coumaroyl quinic acid, Caffeic acid, *p*-Coumaric acid, Phloridzin, Phloretin.

25. Spanos, G.A. and Wrolstad, R.E.

Influence of variety, maturity, processing, and storage on the phenolic composition of pear juice.

J. Agric. Food Chem., 1990(a), 38, 817-824.

*Pear juice (from Comice, d'Anjou, and Bartlett varieties).

*Procyanidins B1-B4, Total procyanidins, Catechin, Epicatechin, Cinnamics (oxidized), Arbutin, Rutin, Quercetin galactoside, Isorhamnetin glycosides, Total flavonols, Total phenolics.

26. Spanos, G.A. and Wrolstad, R.E.

Influence of processing and storage on the phenolic composition of Thompson seedless grape juice.

J. Agric. Food Chem., 1990(b), 38(7), 1565-1571.

*Grape juice (from Thompson seedless grapes).

*Procyanidins B1-B4, Trimer + Tetramer, Total procyanidins, Catechin, Epicatechin, Total unknowns.

27. Spanos, G.A., Wrolstad, R.E., and Heatherbell, D.A.

Influence of processing and storage on the phenolic composition of apple juice.

J. Agric. Food Chem., 1990(c), 38(7), 1572-1579.

*Apple juice (from Granny Smith, Red delicious, McIntosh, & Spartan variety).

*Procyanidins B1-B4, Total procyanidins, Catechin, Epicatechin, Quercetin glycosides & totals, Phloretin glycosides & totals, Cinnamics.

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High-performance liquid chromatography of the neutral phenolic compounds of low molecular weight in apple juice.

J. Agric. Food Chem., 1994, 42, 2732-2736.

*Apple juice (N Senora, San Pedro, & San Juan varieties).

*Procyanidins B1, B2, C1 + tetramer, Unknown procyanidin, Catechin, Epicatechin, Phloretin xyloglucoside, Rutin, Isoquercetin + Hyperin, Unknown flavonol, Avicularin, Phloridzin, Quercetrin.

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Wine phenolics: contribution to intake and bioavailability.

Food Res. Int., 2000, 33(6), 461-467.

*Wine (commercial)-Red & White (Merlot, Cabernet-Sauvignon, Grenache, Syrah, Egidola, & Chardonnay).

*Procyanidins B1-B4, Catechin, Epicatechin, Malvidine-3-glucoside, Total phenols, Gallic acid, Caffeic acid, Para-hydroxycoumaric acid, Caftaric acid, Protocatechuic acid.

30. Tomas-Barberan, F.A., Gil, M.I., Cremin, P., Waterhouse, A.L., Hess-Pierce, B., and Kader, A.A.

HPLC-DAD-ESIMS analysis of phenolic compounds in nectarines, peaches, and plums.

J. Agric. Food Chem., 2001, 49, 4748-4760.

*Nectarines (white & yellow flesh), Peaches (white & yellow flesh), Plums (red & yellow).

* Procyanidins (B1 & others for nectarines and peaches; B1, B2, B4, A-type dimers, & others for plums), Catechin, Epicatechin, Quercetin glycosides, Cyanidin glycosides, Hydrocinnamic acid derivatives, Totals.