

Disease type/risk	First Author	Study Title Complete Citation	Date	Abstract	Human	Human cell	Animal	Animal cell
	Bermudez-Soto, M. J.	Bermudez-Soto, M. J.; Tomas-Barberan, F. A., Evaluation of commercial red fruit juice concentrates as ingredients for antioxidant functional juices. <i>European Food Research and Technology</i> 2004 , 219, (2), 133-141.	2004	Phenolic profiles of nine red fruit commercial juice concentrates were characterised by means of high-performance liquid chromatography-diode array detection-mass spectrometry-mass spectrometry. Flavonoids such as anthocyanins, flavonols, hydroxycinnamic acid derivatives, stilbenoids, flavan 3-ols, ellagic acid derivatives, and other phenolic acids, were both identified and quantified in chokeberry, elderberry, blackcurrant and redcurrant, strawberry, red grape, cherry, plum, and raspberry commercial juice concentrates. Once the characterisation was carried out, the antioxidant capacity of each concentrate was assessed in vitro by means of two different methods: the 2,2'-azinobis(3-ethylbenzthiazoline-6-sulfonic acid) (Trolox equivalent antioxidant capacity) method and the 2,2-diphenyl-1-picrylhydrazyl radical method. Elderberry, chokeberry and blackcurrant concentrates were the richest in total phenolics and they had the strongest antioxidant capacity; therefore, these three juices may have huge interest as ingredients in the design of functional juices.				
	Camire, M. E.	Camire, M. E.; Dougherty, M. P.; Briggs, J. L., Functionality of fruit powders in extruded corn breakfast cereals. <i>Food Chemistry</i> 2007 , 101, (2), 765-770.	2007	Consumer interest in naturally colored foods such as breakfast cereals is growing. Degermed white cornmeal, sucrose, citric acid and dehydrated fruit powder (blueberry, cranberry, Concord grape and raspberry) were mixed in 84.3%:14.3%:0.4%:1.0% proportions, then extruded in a laboratory-scale twin-screw extruder. Feed rate was 255 g/min; water was pumped at a rate of 12.5 g/min; screw speed was 175 rpm. Cooking temperature during extrusion was generally powders survive extrusion and retain some antioxidant activity, the levels used in this study may have been too low. Higher levels of fruit will increase production costs, but the expense may be offset by the more attractive and functional cereals that result.				

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	Elisia, I.	<p data-bbox="380 183 711 232">Elisia, I.; Hu, C.; Popovich, D. G.; Kitts, D. D.,</p> <p data-bbox="380 256 711 329">Antioxidant assessment of an anthocyanin-enriched blackberry extract.</p> <p data-bbox="380 354 711 402">Food Chemistry 2007, 101, (3), 1052-1058.</p>	2007	<p data-bbox="787 183 1604 500">Gel filtration of black berry (<i>Rubus fruticosus</i> sp) ethanolic extracts was employed to obtain an anthocyanin-enriched extract. The anthocyanin profile identified cyanidin-3-glucoside as the primary (e.g., 90% of total) anthocyanin present in blackberry. Gel filtration of crude extracts resulted in a 20-fold increase in total anthocyanin content, with no change in the proportion of cyanidin-3-glucoside. Antioxidant activities of both the crude and anthocyanin-enriched blackberry extracts were determined using cell-free (ORAC) and cell-based (INT-407 intracellular) antioxidant assays. Antioxidant activity, assessed by the ORAC assay, indicated a 7-fold increase in activity for the anthocyanin-enriched fraction. Similar results were obtained for the anthocyanin-enriched extract using the intracellular antioxidant assay with INT-407 cells. Our results indicate that the anthocyanin content, and more specifically the presence of cyanidin-3-glucoside, in blackberry, contributes a major part of the antioxidant ability to suppress both peroxyl radical-induced chemical and intracellular oxidation.</p>				
	Iannetta, P. P. M.	<p data-bbox="380 583 711 656">Iannetta, P. P. M.; van den Berg, J.; Wheatley, R. E.; McNicol, R. J.; Davies, H. V.,</p> <p data-bbox="380 680 711 753">The role of ethylene and cell wall modifying enzymes in raspberry (<i>Rubus idaeus</i>) fruit ripening.</p> <p data-bbox="380 777 711 826">Physiologia Plantarum 1999, 105, (2), 338-347.</p>	1999	<p data-bbox="787 583 1604 1021">This study focuses on four raspberry (<i>Rubus idaeus</i>) genotypes from two different genetic backgrounds: cvs Glen Prosen and Glen Clova, bred at the Scottish Crop Research Institute (SCRI) and genotypes bred at Horticulture Research International (HRI), East Mailing (EM), EM 1997 and EM 5007. The ripe fruit of each genotype pair were characterised subjectively by raspberry breeders as relatively firm or soft, respectively. Different stages of fruit development from each genotype were used to quantify fruit firmness, rates of ethylene evolution and ripening rate. Penetrometry data confirmed suspected firmness differences, Firmness correlated with rates of ethylene evolution. Rates of ethylene production also correlated with receptacle size. Storage of green fruits in 20 μl l⁻¹ ethylene reduced fruit firmness, enhanced respiration rate and colour (anthocyanin) development and stimulated the development of cell wall hydrolase activities. However, during natural ripening in the field, fruit respiration rate declined, which indicates a non-climacteric ripening pattern. In drupelets, the activities of polygalacturonase (PG); pectin methylesterase (PME) Cx-cellulase (Cx) and beta-galactosidase (beta-gal.) increased substantially as ripening progressed, More detailed studies with ripe fruit of cv. Glen Clova indicated major isoforms of PG at pls 3.3, 8.6 and 10.1; of PME at pls 7.2, 8.5, 8.7, 8.8; of Cx at pi 2.4 and of beta-gal. at pls 6.3 and 6.7.</p>				

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	Kalt, W.	<p>Kalt, W.; Forney, C. F.; Martin, A.; Prior, R. L.,</p> <p>Antioxidant capacity, vitamin C, phenolics, and anthocyanins after fresh storage of small fruits.</p> <p>J Agric Food Chem 1999, 47, (11), 4638-44.</p>	1999	<p>Fresh strawberries (<i>Fragaria x ananassa</i> Duch.), raspberries (<i>Rubus idaeus</i> Michx.), highbush blueberries (<i>Vaccinium corymbosum</i> L.), and lowbush blueberries (<i>Vaccinium angustifolium</i> Aiton) were stored at 0, 10, 20, and 30 degrees C for up to 8 days to determine the effects of storage temperature on whole fruit antioxidant capacity (as measured by the oxygen radical absorbing capacity assay, Cao et al., Clin. Chem. 1995, 41, 1738-1744) and total phenolic, anthocyanin, and ascorbate content. The four fruit varied markedly in their total antioxidant capacity, and antioxidant capacity was strongly correlated with the content of total phenolics (0.83) and anthocyanins (0.90). The antioxidant capacity of the two blueberry species was about 3-fold higher than either strawberries or raspberries. However, there was an increase in the antioxidant capacity of strawberries and raspberries during storage at temperatures >0 degrees C, which was accompanied by increases in anthocyanins in strawberries and increases in anthocyanins and total phenolics in raspberries. Ascorbate content differed more than 5-fold among the four fruit species; on average, strawberries and raspberries had almost 4-times more ascorbate than highbush and lowbush blueberries. There were no ascorbate losses in strawberries or highbush blueberries during 8 days of storage at the various temperatures, but there were losses in the other two fruit species. Ascorbate made only a small contribution (0.4-9.4%) to the total antioxidant capacity of the fruit. The increase observed in antioxidant capacity through postharvest phenolic synthesis and metabolism suggested that commercially feasible technologies may be developed to enhance the health functionality of small fruit crops.</p>				
	Lohachoompol, V.	<p>Lohachoompol, V.; Szrednicki, G.; Craske, J.,</p> <p>The Change of Total Anthocyanins in Blueberries and Their Antioxidant Effect After Drying and Freezing.</p> <p>J Biomed Biotechnol 2004, 2004, (5), 248-252.</p>	2004	<p>This study examined the effects of freezing, storage, and cabinet drying on the anthocyanin content and antioxidant activity of blueberries (<i>Vaccinium corymbosum</i> L.). Fresh samples were stored for two weeks at 5°C while frozen samples were kept for up to three months at -20°C. There were two drying treatments, one including osmotic pretreatment followed by cabinet drying and the other involving only cabinet drying. Total anthocyanins found in fresh blueberries were 7.2 µm 0.5 mg/g dry matter, expressed as cyanidin 3-rutinoside equivalents. In comparison with fresh samples, total anthocyanins in untreated and pretreated dried blueberries were significantly reduced to 4.3 µm 0.1 mg/g solid content, 41% loss, and 3.7 µm 0.2 mg/g solid content, 49% loss, respectively. Osmotic treatment followed by a thermal treatment had a greater effect on anthocyanin loss than the thermal treatment alone. In contrast, the frozen samples did not show any significant decrease in anthocyanin level during three months of storage. Measurement of the antioxidant activity of anthocyanin extracts from blueberries showed there was no significant difference between fresh, dried, and frozen blueberries.</p>				

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	Moyer, R.	<p>Moyer, R.; Hummer, K.; Wrolstad, R.E.; Finn, Ch.</p> <p>Antioxidant compounds in diverse ribes and rubus germplasm</p> <p><i>Acta Hort. (ISHS)</i> 585, 501-505.</p>		<p>The high antioxidant content of berry crops provides possible health benefits such as reduction of coronary heart disease, improved visual acuity, anti-viral and anti-cancer activity. Our objective was to determine the range of total anthocyanin content (ACY), total phenolic content (TPH) and antioxidant capacity in diverse species and cultivar germplasm of dark fruited currants and gooseberries, <i>Ribes</i> L., and blackberries and black raspberries (<i>Rubus</i> L.). Ripe fruit was harvested from 22 June 2000 to 15 September 2000 from 45 berry genotypes growing in the Willamette Valley, Oregon. The fruit was hand-picked, stored on ice in the field, and frozen at -23oC in the laboratory that same afternoon. ACY was determined by the pH differential method. Anthocyanin pigments were separated by high pressure liquid chromatography (HPLC). TPH was determined via the Folin-Ciocalteu method. Antioxidant capacity was measured by oxygen radical absorbing capacity (ORAC). ACY for <i>Ribes nigrum</i> L. cultivars ranged from 128 to 411 mg ACY/100g fruit; for blackberries (<i>Rubus</i> hybrid) from 94 to 230 mg ACY/100g fruit; for black raspberries (<i>Rubus niveus</i> Thunb., <i>R. occidentalis</i> L., and <i>R. leucodermis</i> Douglas ex Torrey & A. Gray) from 230 to 627 mg ACY/100g fruit. Some blackcurrants were rich sources of ACY, TPH, and ORAC though gooseberries and jostaberries were not as rich as blackcurrants. <i>Ribes valdivianum</i> Phil., a Chilean native, had the highest TPH (1790 mg gallic acid/100g fruit) and ORAC 115 µmol trolox equivalents/1g fruit, and <i>R. occidentalis</i> cv. Munger had the highest ACY (627 mg ACY/100g) of all tested <i>Ribes</i> and <i>Rubus</i> genotypes. <i>Rubus ursinus</i> Cham. and Schld. hybrid 'Marion' had the highest blackberry ACY (230 mg ACY/100g). ACY was highly correlated to TPH and ORAC in <i>Rubus</i> and <i>Ribes</i>. We suspect that other antioxidant compounds, such as Vitamin C, compose a significant part of TPH and antioxidant capacity in <i>Ribes</i>. <i>Rubus</i> and <i>Ribes</i> genotypes contain much higher ACY, TPH, and antioxidant capacities than are found in most other fruits and vegetables.</p>				
	Mullen, W.	<p>Mullen, W.; Yokota, T.; Lean, M. E.; Crozier, A.,</p> <p>Analysis of ellagitannins and conjugates of ellagic acid and quercetin in raspberry fruits by LC-MSn.</p> <p><i>Phytochemistry</i> 2003, 64, (2), 617-24.</p>	2003	<p>The use of gradient reversed phase HPLC with diode array and MS(n) detection for the analysis of ellagitannins, ellagic acid conjugates and quercetin conjugates in raspberries (<i>Rubus idaeus</i> L.) is described. MS(n) is a particularly powerful tool for the analysis of trace levels of natural products in impure extracts as interpretation of fragmentation patterns, coupled in some instances with knowledge of HPLC retention properties, can facilitate the partial identification of components when reference compounds are unavailable.</p>				

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	Rein, M. J.	<p>Rein, M. J.; Ollilainen, V.; Vahermo, M.; Yli-Kauhaluoma, J.; Heinonen, M.,</p> <p>Identification of novel pyranoanthocyanins in berry juices.</p> <p>European Food Research and Technology 2005, 220, (3-4), 239-244.</p>	2005	<p>In most fruit and berry products the attractive red color is unstable and easily susceptible to degradation. The colors of strawberry and raspberry juices can be enhanced and stabilized by the addition of cinnamic acids. The aim of this study was to identify the novel anthocyanin products responsible for the improved juice color. The pyranoanthocyanins formed were detected using high-performance liquid chromatography, and the fractions from this were analyzed using a nano-ESI tandem MS technique. The pyranoanthocyanins identified were formed from reactions of the main anthocyanins of strawberry and raspberry juices with ferulic acid or sinapic acid. The new anthocyanin derivatives were the 4-vinylguaiacol and 4-vinylsyringol adducts of pelargonidin and cyanidin. This is the first time that pelargonidin 3-glucoside-based vinylphenol pyranoanthocyanins and pyranoanthocyanins with more complex sugar residues have been found. This is also the first time pyranoanthocyanins have been detected in strawberry and raspberry juices.</p>				
	Rimando, A. M.	<p>Rimando, A. M.; Kalt, W.; Magee, J. B.; Dewey, J.; Ballington, J. R.,</p> <p>Resveratrol, pterostilbene, and piceatannol in vaccinium berries.</p> <p><i>J Agric Food Chem</i> 2004, 52, (15), 4713-9.</p>	2004	<p>A study was conducted to determine the presence of resveratrol, pterostilbene, and piceatannol in <i>Vaccinium</i> berries. Samples representing selections and cultivars of 10 species from Mississippi, North Carolina, Oregon, and Canada were analyzed by gas chromatography/mass spectrometry. Resveratrol was found in <i>Vaccinium angustifolium</i> (lowbush blueberry), <i>Vaccinium arboretum</i> (sparkleberry), <i>Vaccinium ashei</i> (rabbiteye blueberry), <i>Vaccinium corymbosum</i> (highbush blueberry), <i>Vaccinium elliotii</i> (Elliott's blueberry), <i>Vaccinium macrocarpon</i> (cranberry), <i>Vaccinium myrtillus</i> (bilberry), <i>Vaccinium stamineum</i> (deerberry), <i>Vaccinium vitis-ideae</i> var. <i>vitis-ideae</i> (lingonberry), and <i>Vaccinium vitis-ideae</i> var. <i>minor</i> (partridgeberry) at levels between 7 and 5884 ng/g dry sample. Lingonberry was found to have the highest content, 5884 ng/g dry sample, comparable to that found in grapes, 6471 ng/g dry sample. Pterostilbene was found in two cultivars of <i>V. ashei</i> and in <i>V. stamineum</i> at levels of 99-520 ng/g dry sample. Piceatannol was found in <i>V. corymbosum</i> and <i>V. stamineum</i> at levels of 138-422 ng/g dry sample. These naturally occurring stilbenes, known to be strong antioxidants and to have cancer chemopreventive activities, will add to the purported health benefits derived from the consumption of these small fruits.</p>				

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	Mullen, W.	<p>Mullen, W.; Stewart, A. J.; Lean, M. E.; Gardner, P.; Duthie, G. G.; Crozier, A.,</p> <p>Effect of freezing and storage on the phenolics, ellagitannins, flavonoids, and antioxidant capacity of red raspberries.</p> <p><i>J Agric Food Chem</i> 2002, 50, (18), 5197-201.</p>	2002	<p>Scottish-grown red raspberries are a rich source of vitamin C and phenolics, most notably, the anthocyanins cyanidin-3-sophoroside, cyanidin-3-(2(G)-glucosylrutinoside), and cyanidin-3-glucoside, and two ellagitannins, sanguin H-6 and lambertianin C, which are present together with trace levels of flavonols, ellagic acid, and hydroxycinnamates. The antioxidant capacity of the fresh fruit and the levels of vitamin C and phenolics were not affected by freezing. When fruit were stored at 4 degrees C for 3 days and then at 18 degrees C for 24 h, mimicking the route fresh fruit takes after harvest to the supermarket and onto the consumer's table, anthocyanin levels were unaffected while vitamin C levels declined and those of ellagitannins increased, and overall, there was no effect on the antioxidant capacity of the fruit. It is concluded, therefore, that freshly picked, fresh commercial, and frozen raspberries all contain similar levels of phytochemicals and antioxidants per serving.</p>				
	Parry, J.	<p>Parry, J.; Su, L.; Luther, M.; Zhou, K.; Yurawecz, M. P.; Whittaker, P.; Yu, L.,</p> <p>Fatty acid composition and antioxidant properties of cold-pressed marionberry, boysenberry, red raspberry, and blueberry seed oils.</p> <p><i>J Agric Food Chem</i> 2005, 53, (3), 566-73.</p>	2005	<p>Cold-pressed marionberry, boysenberry, red raspberry, and blueberry seed oils were evaluated for their fatty acid composition, carotenoid content, tocopherol profile, total phenolic content (TPC), oxidative stability index (OSI), peroxide value, and antioxidant properties. All tested seed oils contained significant levels of alpha-linolenic acid ranging from 19.6 to 32.4 g per 100 g of oil, along with a low ratio of n-6/n-3 fatty acids (1.64-3.99). The total carotenoid content ranged from 12.5 to 30.0 micromoles per kg oil. Zeaxanthin was the major carotenoid compound in all tested berry seed oils, along with beta-carotene, lutein, and cryptoxanthin. Total tocopherol was 260.6-2276.9 mumoles per kg oil, including alpha-, gamma-, and delta-tocopherols. OSI values were 20.07, 20.30, and 44.76 h for the marionberry, red raspberry, and boysenberry seed oils, respectively. The highest TPC of 2.0 mg gallic acid equivalents per gram of oil was observed in the red raspberry seed oil, while the strongest oxygen radical absorbance capacity was in boysenberry seed oil extract (77.9 micromol trolox equivalents per g oil). All tested berry seed oils directly reacted with and quenched DPPH radicals in a dose- and time-dependent manner. These data suggest that the cold-pressed berry seed oils may serve as potential dietary sources of tocopherols, carotenoids, and natural antioxidants.</p>				

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	Rommel, A.	<p>Rommel, A.; Wrolstad, R. E.,</p> <p>Composition of Flavonols in Red Raspberry Juice as Influenced by Cultivar, Processing, and Environmental-Factors.</p> <p><i>Journal of Agricultural and Food Chemistry</i> 1993, 41, (11), 1941-1950.</p>	1993	<p>Flavonols were characterized and measured in experimental (n = 46) and commercial (n = 9) red raspberry juices by HPLC/diode array spectral techniques. Samples were prepared using minicolumns, packed with Polyamide 6. A fraction eluted with methanol contained eight or fewer quercetin glycosides, quercetin, and kaempferol. A second fraction eluted subsequently with 0.5% ammonia in methanol contained three flavonol glucuronides, two flavonol forms, aglycons, ellagic acid, and its derivatives. Quercetin 3-glucuronide was the major flavonol in experimental and commercial juices, respectively (mean of 54 and 51 ppm), and a flavonol presumed to be quercetin 3-sophoroside was the second primary compound (means of 29 and 33 ppm). In addition, 36 flavonol forms were measured in trace amounts. The mean total concentrations of quercetin and kaempferol forms, respectively, in experimental juices (n = 45) were 118 and 3.6 ppm and in commercial juices (n = 7) 121 and 3.4 ppm, respectively. The mean total flavonol concentrations in experimental and commercial juices were 122 and 125 ppm, respectively. Influences of cultivar (n = 10), processing method (standard, high-speed centrifugation, depectinization, diffusion extraction, vacuum and osmotic concentration) and environmental factors (geographic origin, maturity, harvesting method, mold contamination) were evaluated.</p>				
	Rommel, A.	<p>Rommel, A.; Wrolstad, R. E.,</p> <p>Ellagic Acid Content of Red Raspberry Juice as Influenced by Cultivar, Processing, and Environmental-Factors.</p> <p><i>Journal of Agricultural and Food Chemistry</i> 1993, 41, (11), 1951-1960.</p>	1993	<p>Ellagic acid and its derivatives present in pilot-plant-processed raspberry juices and commercial juice concentrates were characterized and concentrations estimated using HPLC/diode array spectral techniques. Experimental juice samples (n = 45) contained a mean concentration of 10 ppm of ellagic acid and less-than-or-equal-to 16 derivatives of ellagic acid with individual mean concentrations of up to 3 ppm. Commercial juices (n = 7) contained more ellagic acid and derivatives than experimental juices, with a mean concentration of 30 ppm of ellagic acid and up to 6.7 ppm for individual ellagic acid derivatives. The mean total concentration of ellagic acid and its derivatives in experimental juices was 28 ppm and in commercial juices 52 ppm. Qualitatively, the chromatographic profiles were very similar for the juices studied, but quantitatively, there were great differences due to cultivar (n = 10) and processing method. Williamette and Meeker cultivars contained the most ellagic acid and its forms. Juices made by diffusion extraction and a standard process had by far the highest concentrations of ellagic acid and its forms. High-speed centrifugation reduced total ellagic acid forms by half compared to diffusion extraction; depectinization and concentration decreased total forms even further.</p>				

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	Seeram, N. P.	<p>Seeram, N. P.; Henning, S. M.; Zhang, Y. J.; Suchard, M.; Li, Z. P.; Heber, D.,</p> <p>Pomegranate juice ellagitannin metabolites are present in human plasma and some persist in urine for up to 48 hours.</p> <p><i>Journal of Nutrition</i> 2006, 136, (10), 2481-2485.</p>	2006	<p>Ellagitannins (ETs) from pomegranate juice (PJ) are reported to have numerous biological properties, but their absorption and metabolism in humans are poorly understood. To investigate the pharmacokinetics of pomegranate ETs, 18 healthy volunteers were given 180 mL of PJ concentrate, and blood samples were obtained for 6 h afterwards. Twenty-four-hour urine collections were obtained on the day before (-1), the day of (0), and the day after (+1) the study. Ellagic acid (EA) was detected in plasma of all subjects with a maximum concentration of 0.06 +/- 0.01 mu mol/L, area under concentration time curve of 0.17 +/- 0.02 (mu mol (.) h) (.) L-1, time of maximum concentration of 0.98 +/- 0.06 h, and elimination half-life of 0.71 +/- 0.08 h. EA metabolites, including dimethylellagic acid glucuronide (DMEAG) and hydroxy-6H-benzopyran-6-one derivatives (urolithins), were also detected in plasma and urine in conjugated and free forms. DMEAG was found in the urine obtained from 15 of 18 subjects on d 0, but was not detected on d - 1 or + 1, demonstrating its potential as a biomarker of intake. Urolithin A-glucuronide was found in urine samples from 11 subjects on d 0 and in the urine from 16 subjects on d + 1. Urolithin B-glucuronide was found in the urine of 3 subjects on d 0 and in the urine of 5 subjects on d + 1. Urolithins, formed by intestinal bacteria, may contribute to the biological effects of PJ as they may persist in plasma and tissues and account for some of the health benefits noted after chronic PJ consumption. Whether genetic polymorphisms in EA-metabolizing enzymes (e.g., catechol-O-methyl transferase and glucuronosyl transferase) are related to variations in response to PJ remains to be established.</p>	x			
	Sun, Y.	<p>Sun, Y.; Liao, X.; Wang, Z.; Hu, X.; Cheng, F.</p> <p>Optimization of microwave-assisted extraction of anthocyanins in red raspberries and identification of anthocyanin of extracts using high-performance liquid chromatography - mass spectrometry.</p> <p><i>European Food Research and Technology</i>.</p>	2006	<p>Anthocyanins (Acys) are naturally occurring compounds that impart color to fruit, vegetables, and plants. The extraction of Acys from red raspberry (<i>Rubus idaeus</i> L. var. Heritage) by microwave-assisted process (MAP) was studied. A central composite rotata design (CCRD) was used to obtain the optimal conditions of microwave-assisted extraction (MAE), and the effects of operating conditions such as the ratio of solvents to materials, microwave power and extraction time on the extraction yield of Acys were studied through response surface methodology (RSM). The optimized conditions of MAE were ratio of solvents to materials 4:1 (ml/g), extraction time 12 min, and microwave power 366W. Under these conditions 43.42 mg of Acys from 100 g of fresh fruits (TAcy, expressed as cyanidin-3-glucoside), approximately 98.33% of the total red pigments, could be obtained by MAE. The Acys compositions of extracts were identified by high-performance liquid chromatography – mass spectrometry (HPLC-MS), 12 kinds of Acys had been detected and 8 kinds of Acys were characterized. Result indicated that cyanidin-3-sophoroside, cyanidin-3-(2Gglucosylrutinoside), cyanidin-3-sambubioside, cyanidin-3- rutinoside, cyanidin-3-xylosylrutinoside, cyanidin-3-(2Gglucosylrutinoside), and cyanidin-3-rutinoside were main components in extracts. In addition, in comparison with the conventional solvent extraction, MAE is more efficient and rapid to extract Acys from red raspberry, due to the strong disruption of fruit tissue structure under microwave irradiation, which had been observed with the scanning electron.</p>				

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	Zafrilla, P.	<p>Zafrilla, P.; Ferreres, F.; Tomas-Barberan, F. A.,</p> <p>Effect of processing and storage on the antioxidant ellagic acid derivatives and flavonoids of red raspberry (<i>Rubus idaeus</i>) jams.</p> <p><i>J Agric Food Chem</i> 2001, 49, (8), 3651-5.</p>	2001	<p>From red raspberries, ellagic acid, its 4-arabinoside, its 4' (4' '-acetyl) arabinoside, and its 4' (4' '-acetyl)xyloside, as well as quercetin and kaempferol 3-glucosides, were identified. In addition, two unidentified ellagic acid derivatives were detected. The free radical scavenging activity of the ellagic acid derivatives was evaluated by using the DPPH method and compared to that of Trolox. All of the isolated compounds showed antioxidant activity. The effect of processing to obtain jams on raspberry phenolics was evaluated. The flavonol content decreased slightly with processing and more markedly during storage of the jams. The ellagic acid derivatives, with the exception of ellagic acid itself, remained quite stable with processing and during 6 months of jam storage. The content of free ellagic acid increased 3-fold during the storage period. The initial content (10 mg/kg of fresh weight of raspberries) increased 2-fold with processing, and it continued increasing up to 35 mg/kg after 1 month of storage of the jam. Then a slight decrease was observed until 6 months of storage had elapsed. The increase observed in ellagic acid could be explained by a release of ellagic acid from ellagitannins with the thermal treatment.</p>				
	Hakkinen SH	<p>Hakkinen SH, Karenlampi SO, Mykkanen HM, Heinonen IM, Torronen AR</p> <p>Ellagic acid content in berries: Influence of domestic processing and storage.</p> <p>European Food Research and Technology 2000, V212, (1), 75-80.</p>	2000	<p>The content of ellagic acid was determined from the berries of the family Rosaceae (strawberry, red raspberry, cloudberry, arctic bramble). Extraction and hydrolysis procedures were optimized and analysis was done with an HPLC method and UV detection. The influence of processing on ellagic acid content was studied in strawberry jam. Strawberries, red raspberries, and strawberry jam were analyzed fresh and after 3, 6, and 9 months of storage in a domestic freezer or refrigerator. Ellagic acid contents after 3 months of storage at -20 degreesC varied between 31.5 (strawberry 'Senga Sengana') and 68.6 mg/100 g f.w. (arctic bramble). Ellagic acid content in strawberry jam (23.8 mg/100 g f.w.) was 80% of that in unprocessed strawberries. The content of ellagic acid in strawberries and red raspberries was reduced by 40% and 30%, respectively, during the 9 months of storage at -20 degreesC. The unprocessed berries studied, together with nuts, make the main contribution to the total dietary intake of ellagic acid in Finland.</p>				

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	Viljanen, K.	<p data-bbox="380 183 711 228">Viljanen, K.; Halmos, A. L.; Sinclair, A.; Heinonen, M.,</p> <p data-bbox="380 256 711 326">Effect of blackberry and raspberry juice on whey protein emulsion stability.</p> <p data-bbox="380 354 711 423">European Food Research and Technology 2005, 221, (5), 602-609.</p>	2005	<p data-bbox="787 183 1604 570">The effect of raspberry and blackberry juice on oil-in-water (o/w) emulsion oxidative stability was investigated with different concentrations of whey proteins and rapeseed oil. The extent of lipid oxidation was measured by determining conjugated diene hydroperoxides and thiobarbituric acid reactive substances and that of protein oxidation by loss of natural tryptophan fluorescence and formation of protein carbonyl compounds. In addition, the anthocyanin colour stability and emulsion turbidity were measured. The increasing concentration of whey proteins and berry juices led to enhanced stabilization of the interface formed during emulsification. The anthocyanin concentration and colour decreased during oxidation leading to whiter emulsions. Raspberry juice provided a better overall antioxidant protection towards lipid and protein oxidation compared to blackberry juice. The antioxidant activity of berry juices towards lipid oxidation varied with concentration. The antioxidant activity increased with increasing concentration of berry juices. In conclusion, red berry juice anthocyanins, as well as other phenolic compounds, act as antioxidants improving the oxidative stability of whey protein emulsions. However, the antioxidant protection is different towards protein and lipid oxidation, and is also affected by other components present.</p>				