

Content of redox-active compounds (ie, antioxidants) in foods consumed in the United States¹⁻³

Bente L Halvorsen, Monica H Carlsen, Katherine M Phillips, Siv K Bøhn, Kari Holte, David R Jacobs Jr, and Rune Blomhoff

ABSTRACT

Background: Supplements containing ascorbic acid, α -tocopherol, or β -carotene do not protect against oxidative stress-related diseases in most randomized intervention trials. We suggest that other redox-active phytochemicals may be more effective and that a combination of different redox-active compounds (ie, antioxidants or reductants) may be needed for proper protection against oxidative damage.

Objective: We aimed to generate a ranked food table with values for total content of redox-active compounds to test this alternative antioxidant hypothesis.

Design: An assay that measures the total concentration of redox-active compounds above a certain cutoff reduction potential was used to analyze 1113 food samples obtained from the US Department of Agriculture National Food and Nutrient Analysis Program.

Results: Large variations in the content of antioxidants were observed in different foods and food categories. The food groups spices and herbs, nuts and seeds, berries, and fruit and vegetables all contained foods with very high antioxidant contents. Most food categories also contained products almost devoid of antioxidants. Of the 50 food products highest in antioxidant concentrations, 13 were spices, 8 were in the fruit and vegetables category, 5 were berries, 5 were chocolate-based, 5 were breakfast cereals, and 4 were nuts or seeds. On the basis of typical serving sizes, blackberries, walnuts, strawberries, artichokes, cranberries, brewed coffee, raspberries, pecans, blueberries, ground cloves, grape juice, and unsweetened baking chocolate were at the top of the ranked list.

Conclusion: This ranked antioxidant food table provides a useful tool for investigations into the possible health benefit of dietary antioxidants. *Am J Clin Nutr* 2006;84:95-135.

KEY WORDS Redox active compounds, oxidative stress, antioxidants, chronic degenerative diseases, oxidative damage, ferric reducing ability of plasma

INTRODUCTION

The source of energy for most forms of life is photosynthesis, which converts solar energy into redox energy in plants (1). Plants contain high concentrations of numerous redox-active secondary metabolites (ie, antioxidants), such as polyphenols, carotenoids, tocopherols, tocotrienols, glutathione, ascorbic acid, and enzymes with antioxidant activity, which help to protect them from hazardous oxidative damage to plant cell components (1, 2). In animal cells, de novo antioxidant production is much more limited, and oxidative damage is involved in the

pathogenesis of most chronic degenerative diseases and aging (3-5). Furthermore, increased amounts of reactive oxygen and nitrogen species (ROS/RNS) are formed in animal cells as a consequence of disease processes (eg, inflammation) and from tobacco smoke, environmental pollutants, food constituents, drugs, ethanol, and radiation (3-6), and, if not eliminated by antioxidants, they may damage extracellular or cellular components (3-6). Oxidative stress reduction through the dietary intake of antioxidants from fruit and vegetables has been suggested to reduce such oxidative damage (7, 8). Many cell culture and experimental animal studies (6, 7, 9-11), as well as observational epidemiologic studies (7, 10, 11), support the hypothesis that intake of foods rich in α -tocopherol, β -carotene, and ascorbic acid were associated with reduced oxidative stress-related diseases. However, large randomized intervention trials using α -tocopherol or β -carotene have not been supportive (12-18). One possible explanation may be that the beneficial health effect is contributed by other antioxidants in fruit and vegetables. There are numerous antioxidants in plants consumed in the diet, including several hundred naturally occurring carotenoids and several thousand phenolic compounds, eg, benzoic acid derivatives, flavonoids, proanthocyanidins, stilbenes, coumarins, lignans, and lignins (19). We suggest that these redox-active compounds, which cooperate in an integrated manner in plants cells, also may cooperate in animal cells. Thus, a network of antioxidants with different chemical properties may be needed for proper protection against oxidative damage (3, 20-22). A ranked table with the total concentration of redox-active secondary plant metabolites

¹ From the Department of Nutrition, Institute of Basic Medical Sciences, University of Oslo, Oslo, Norway (BLH, MHC, SKB, KH, and RB); the Biochemistry Department, Virginia Polytechnic Institute and State University, Blacksburg, VA (KMP); and the Division of Epidemiology and Community Health, School of Public Health, University of Minnesota, Minneapolis, MN (DRJ).

² Supported by The Research Council of Norway, The Throne Holst Foundation, and the Norwegian Cancer Society. Food samples were obtained as part of specific agreement Y1-HV-8116-11 between the USDA Nutrient Data Laboratory and Virginia Polytechnic Institute and State University, with support from the National Heart, Lung, and Blood Institute and the National Cancer Institute through interagency agreement Y1-HV-8116 between the National Institutes of Health and the USDA.

³ Address reprint requests to R Blomhoff, Department of Nutrition, Institute of Basic Medical Sciences, University of Oslo, PO Box 1046 Blindern, 0316 Oslo, Norway. E-mail: rune.blomhoff@medisin.uio.no.

Received November 12, 2005.

Accepted for publication March 15, 2006.

may, therefore, be a useful tool for testing this alternative antioxidant hypothesis. Of the various antioxidant assays available (23–26), we decided to use the ferric reducing ability of plasma (FRAP) assay of Benzie and Strain (27). Results of the analysis of ≈ 200 fruits, vegetables, spices and herbs, cereals, supplements, juices, and drinks sampled mainly from European countries were previously reported (3, 28, 29). In this study we report the results of an analysis of 1113 food samples that were obtained from the US Department of Agriculture (USDA) National Food and Nutrient Analysis Program (NFNAP) (30), which is based on a nationally representative sampling of each food according to a statistical protocol based on US food consumption data.

METHODS

Reagents

TPTZ (2,4,6-tri-pyridyl-*s*-triazine) was obtained from Fluka Chemie AG (Deisenhofen, Switzerland), sodium acetate trihydrate and $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ from Riedel-deHaën AG (Seelze, Germany), acetic acid and hydrochloric acid from Merck (Darmstadt, Germany), and $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ from BDH Laboratory Supplies (Dorset, United Kingdom). MilliQ water (Millipore, Bedford, MA) and methanol of HPLC-grade obtained from Merck was used for all extractions. HPLC-grade 2-propanol was obtained from Merck. Trolox, ascorbic acid, quercetin, myricetin, and α -tocopherol were from Sigma-Aldrich Co (St Louis, MO).

Source of samples

Food samples were obtained from the USDA National Food and Nutrient Analysis Program (NFNAP) (30, 31). Products were collected according to a statistical sampling plan based on US food consumption data, designed to generate nationally representative composites (32, 33). Foods were procured primarily from retail outlets and shipped to a central facility (Virginia Polytechnic Institute and State University, Blacksburg, VA), where they were prepared if necessary (eg, cooked and trimmed of inedible portions), combined into composite samples in some cases, and homogenized. Samples were combined into composites by statistical sampling region or as a single nationwide composite, except for some foods that were shipped directly from the supplier (*see* footnotes to Tables). Many of the food composites from the NFNAP (172 raw and cooked fresh fruit and vegetables, nuts and seeds, and spices) have also been assayed by using the oxygen radical absorbance capacity method, and the data along with further details on sampling have been reported (33, 34).

Foods and composites were prepared according to standardized, thoroughly documented procedures. Each composite was typically 1000–3000 g in total weight. Representative subsamples of the original foods were taken as necessary. Fresh fruit and vegetables were trimmed of inedible portions (eg, cores, stems, and moldy or bruised areas) immediately before homogenization. Cooked foods were prepared by using conventional methods (eg, microwaving, oven baking, sautéing, boiling, and steaming) following label directions for packaged products. Most composites were homogenized with a 6-L capacity industrial food processor (model RSI6V or BS6V; Robot Coupe USA Inc, Jackson, MS). Fresh fruit and vegetables and other foods (eg, chocolate candy, potato chips, and prepared cakes) were frozen

in liquid nitrogen before and during blending. Other homogenization techniques were used, depending on the type of food, and included simple stirring for homogeneous liquids and powders (eg, water, clear juices, oils, and drink mixes), mixing with a hand blender (salad dressings), and grinding with a mill (popcorn kernels and uncooked rice).

Each homogenate was dispensed among 30- or 60-mL glass jars with polytetrafluoroethylene-lined lids (Qorpak, Bridgeton, PA), sealed under nitrogen, and stored at $-60 \pm 5^\circ\text{C}$ in the dark. Homogeneity was validated by analysis of moisture, total lipid, ash, or minerals in aliquots drawn from across the typical dispensing sequence of selected composites as described elsewhere (35). The range of storage time at Virginia Tech was from 1 to 63 mo. Samples were shipped on dry ice via express air delivery from Blacksburg, VA, to Oslo, Norway; received in a frozen condition; and stored at -80°C before analysis. The range of storage time in Oslo was from 0 to 25 wk.

Details of sample description and source, preparation methods, edible yield, compositing and homogenization procedures, and storage were maintained for every food sample and composite but are not included in this report.

Sample preparation

After being thawed, the composites were homogenized, and the analytic aliquots were weighed. Most of the samples were extracted in methanol:water (9:1, by vol). Because of difference in solubility, vegetable oils were extracted in 10 mL 2-propanol. Some fat-rich samples were extracted in 2-propanol:water (9:1, by vol). These alternative extraction procedures gave higher antioxidant values for vegetable oils and the fat-rich foods compared with methanol:water (9:1, by vol). For all other food samples tested, methanol:water (9:1) gave the highest antioxidant value (the solvent used for extraction is indicated in the footnotes to the data tables). The samples were mixed, sonicated in an ice water bath at 0°C for 15 min, and mixed once more. Three 1.5-mL samples were centrifuged at $12.402 \times g$ for 2 min at 4°C . The concentration of antioxidants was measured in triplicate aliquots of the supernatant fluid (ie, 9 data points per sample).

Measurements of redox-active compounds, ie, antioxidants

The antioxidant assay of Benzie and Strain (26) was used with minor modifications that allowed quantitation of most water- and fat-soluble antioxidants (28, 29). A Technicon RA 1000 system (Technicon Instruments Corporation, Tarrytown, NY) was used for the measurements of absorption changes that appear when the TPTZ- Fe^{3+} complex reduces to the TPTZ- Fe^{2+} form in the presence of antioxidants. An intense blue color with absorption maximum at 593 nm develops. The measurements were performed after 4 min of incubation at 600 nm. An aqueous solution of 500 $\mu\text{mol/L}$ $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ was used to calibrate the instrument. The assay was fully validated as described in a previous report (28). The within-day repeatability measured as relative SD ranged from 0.4% to 6%. The variation in the values for replicate items obtained from the same source was typically between 3 and 10 relative SD (RSD) percentages. Occasionally, some values had a larger variation. In such cases, the antioxidant values were confirmed by reanalysis.

All antioxidant results are reported as absolute values in mmol of electrons/hydrogen atoms donated in the redox reaction per

TABLE 1

Stability of antioxidants in food composites during storage (for 0–65 wk) at -80°C ¹

	Antioxidant content by storage time (wk)											
	0	1	2	3	7	12	17	26	33	44	53	65
	<i>mmol/100 g</i>											
Vitamin E–fortified soybean oil	0.28	0.32	0.27	0.28	0.28	0.28	0.28	0.27	0.27	0.29	0.34	0.26
Oranges, raw	0.87	1.02	0.90	0.97	0.92	0.90	0.96	0.87	0.88	0.98	0.92	0.89
Mixed food	ND	ND	0.17	0.18	0.17	0.17	0.20	0.20	0.20	0.17	0.16	0.18
Strawberry jam	1.32	1.29	1.25	1.34	1.35	1.32	1.39	1.15	1.25	1.30	1.49	1.42
Broccoli, raw	0.21	0.35	0.32	0.36	0.32	0.30	0.38	0.35	0.35	0.25	0.29	0.33
Ready-to-eat breakfast cereal	3.78	4.15	3.49	4.32	3.87	ND	3.76	4.04	3.53	3.50	3.34	3.60

¹ ND, not determined.

100 g of sample. In some reports, antioxidant values are given in trolox equivalents. For conversion of absolute values to trolox equivalents, the following data can be used: Trolox has an activity of 831.00 mmol/100 g ($n = 5$; RSD = 5.5%, ie, 2.08 electrons/hydrogen atoms donated per molecule of trolox) in the assay used in the present study.

The linearity of the method was investigated with standard solutions of $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ and ascorbic acid diluted in water and in methanol, trolox diluted in methanol, and α -tocopherol diluted in methanol and in 2-propanol. The concentrations used were between 10 and 3000 $\mu\text{mol/L}$. All concentrations were used for determination of linearity for $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ in water and methanol, the 6 lowest concentrations were used for α -tocopherol in methanol and 2-propanol, and the 5 lowest concentrations were used for ascorbic acid in water and in methanol and for trolox in methanol. The concentrations were chosen to give an absorbance value of 1.7, which corresponded to an antioxidant value of 3000 $\mu\text{mol/L}$, which was the linear range according to the instrument manual. The correlation coefficients were in the range 1.000 to 0.998.

Different antioxidants in different solvents [ascorbic acid in water, methanol, and methanol:2-propanol (1:1, by vol); quercetin in methanol and 2-propanol; α -tocopherol in methanol, ethanol, and 2-propanol; and myricetin in methanol] at equimolar concentrations gave the same antioxidant value. Thus, these solvents do not influence the examined antioxidants. It was also tested whether different antioxidants in a mixture were additive. The results from the sum of single analyses of each antioxidant corresponded very well with the antioxidant values found in a mixture of the same antioxidants (both in the same and in a mixture of solvents).

Serving sizes

The serving size of a typically consumed portion of each food was determined from the USDA National Nutrient Database for Standard Reference (36), from the US Food and Drug Administration Nutrition Labeling and Education Act (NLEA) guidelines (37), or from actual measurement of average portion weights taken during sample preparation. All serving sizes for fast foods were based on measurements of the samples.

Storage stability studies

Composites of vitamin E–fortified soybean oil, oranges, strawberry jam, raw broccoli, vitamin-enriched whole-grain

ready-to-eat breakfast cereal, and a mixed food (vitamin E–fortified soybean oil, oranges, skim milk, raw broccoli, vitamin-enriched whole-grain ready-to-eat breakfast cereal, meatloaf frozen dinner, and teriyaki chicken frozen dinner) were prepared as described above and frozen immediately at -60°C . Samples were shipped (3 d) from Blacksburg, VA, to Oslo, Norway, on dry ice. Antioxidant contents were determined immediately after arrival and at various times over 0–65 wk at -80°C . The data show that negligible changes in antioxidant content occurred during storage of these samples at -80°C for ≤ 65 wk (Table 1).

Statistics

The Pearson product-moment correlation coefficients were calculated by the Microsoft Excel software (Microsoft Corporation, Redmond, WA).

RESULTS

Content of antioxidants in various food groups

The analysis showed large variations in the content of antioxidants in different foods and food categories. The food categories containing the highest antioxidant contents were spices and herbs, nuts and seeds, chocolate and sweets, vegetables and vegetable products, ready-to-eat cereals, desserts and cakes, and berries and berry products (Table 2). Notably, most of these food categories also contained products almost devoid of antioxidants. The food categories containing products with the lowest antioxidant contents were fats and oils; meat, meat products, and substitutes; poultry and poultry products, fish and seafood, and egg and egg dishes.

The 50 food products with the highest antioxidant content

The 50 food products containing the highest contents of antioxidants are presented in Table 3. Values are presented as the mean of several brands or sources if several items were isolated of same or similar food products. Ground cloves, dried oregano, ground ginger, ground cinnamon, turmeric powder, walnuts, dried basil, and ground mustard seed contained >10 mmol antioxidants/100 g. Of the 50 food products highest in antioxidant content, 13 were spices, 8 were based on fruit and vegetables, 5 were berries, 5 were chocolate-based, 5 were breakfast cereals, and 4 were nuts or seeds. Notably, red wine and brewed coffee

TABLE 2
Antioxidant content in various food categories¹

Product category	Antioxidant content
	<i>mmol/100 g</i>
Spices and herbs	0.803–125.549
Nuts and seeds	0.029–13.126
Chocolates and sweets	0.092–10.474
Vegetables and vegetable products	0.018–4.694
Ready-to-eat cereals	0.157–4.291
Desserts and cakes	0.000–4.097
Berries and berry products	0.978–4.059
Fruit and fruit juices	0.081–2.512
Beverage	0.000–2.135
Soups, sauces, gravies, dressings, etc	0.000–1.566
Fast food	0.001–1.262
Infant foods and beverages	0.017–1.248
Legumes	0.008–1.184
Snacks	0.148–1.170
Grains and grain products	0.009–0.997
Dairy products	0.011–0.763
Mixed-food entrees	0.026–0.731
Fats and oils	0.187–0.531
Meat, meat products, and substitutes	0.052–0.509
Poultry and poultry products	0.072–0.388
Fish and seafood	0.025–0.141
Egg and egg dishes	0.009–0.047

¹ All values are ranges. The food category “miscellaneous ingredients” was omitted because it contains mostly ingredients that are added to other dishes. See Table 6 for this category.

were also among the 50 items with the highest antioxidant content.

The top 50 foods containing most antioxidants per serving are presented in **Table 4**. Based on typical serving sizes, blackberries, walnuts, strawberries, artichokes, cranberries, brewed coffee, raspberries, pecan nuts, blueberries, ground cloves, grape juice, and unsweetened baking chocolate were at the top of the ranked list. All of these foods contained more than 2.5 mmol antioxidants per serving. Of the top 50 food products based on serving size, 15 were fruits or fruit juices, 10 were vegetables, 6 were berry products, 4 were chocolate based, 2 were breakfast cereals and 2 were nuts. Red wine and coffee were also among the top 50 items based on antioxidant content per serving size.

Effect of food processing

The NFNAP set of foods we analyzed contains foods that were either raw (fresh) or that had been processed in various ways (eg, frozen, baked, microwaved, and boiled). In general, antioxidant contents were preserved fairly well during most types of processing, but there were some exceptions. Interestingly, the antioxidant content increased in products such as carrots, spinach, mushrooms, asparagus, broccoli, cabbage, red cabbage, green and red peppers, potatoes, and tomatoes during microwave cooking, steaming, or boiling (**Table 5**). Antioxidant values also increased after toasting or baking of bagels, French bread, wheat bread, whole-wheat bread, and pie crust. A decrease in antioxidant content was only observed after cooking by microwave, steaming, or boiling of corn grits, white rice, or spaghetti. Removing the peel from apples and cucumber decreased the antioxidant content to 33–66% and 50% of the amount in the unpeeled products, respectively.

TABLE 3
The 50 foods with the highest antioxidant content

Product	Antioxidant content ¹
	<i>mmol/100 g</i>
Cloves, ground	125.549
Oregano leaf, dried	40.299
Ginger, ground	21.571
Cinnamon, ground	17.647
Turmeric powder	15.679
Walnuts	13.126
Basil leaf, dried	12.307
Mustard seed, yellow, ground	10.527
Curry powder	9.980
Pecans	9.668
Chocolate, baking, unsweetened	8.876
Paprika	8.601
Chili powder	8.372
Parsley, dried	7.430
Molasses, dark	4.900
Pepper, black	4.444
Artichokes, prepared	4.237
Chocolate, dark	4.188
Blackberries	3.990
Whole-grain cereal	3.412
Cranberries	3.289
Pudding mix, chocolate, cook-and-serve	3.026
Bran cereal	2.925
Power bar, chocolate flavor ²	2.757
Chocolates, sugar-free	2.567
Raspberries	2.334
Strawberries	2.159
Blueberries	2.154
Cabbage, red, cooked	2.153
Wine, red	2.135
Barley malt syrup, organic	2.121
Prunes	2.018
Cherries, sour	1.814
Peppers, red, cooked	1.640
Chocolate cookies with vanilla creme filling	1.604
Cocoa Krispies cereal ³	1.558
Chocolate chip cookies	1.524
Mustard, yellow, prepared	1.501
Milk-chocolate candy	1.483
Pistachios	1.426
Plums	1.330
Kiwi fruit	1.325
Corn flakes	1.255
Coffee	1.249
Spinach, frozen	1.226
Flaxseed, ground or milled	1.125
Rice and corn cereals	1.121
Toasty peanut crackers	1.101
Cupcakes, chocolate	1.059
Grape juice	1.011

¹ All values are means.

² POWERBAR Co, Berkeley, CA.

³ Kellogg Co, Battle Creek, MI.

Complete antioxidant food list

The complete food list, which includes the antioxidant content for different brands and sources of products, is presented in **Table 6**. We observed that 119 of the 1113 products contained



TABLE 4

The 50 foods with the highest antioxidant contents per serving size¹

Product	Antioxidant content <i>mmol/serving</i>
Blackberries	5.746
Walnuts	3.721
Strawberries	3.584
Artichokes, prepared	3.559
Cranberries	3.125
Coffee	2.959
Raspberries	2.870
Pecans	2.741
Blueberries	2.680
Cloves, ground	2.637
Grape juice	2.557
Chocolate, baking, unsweetened	2.516
Cranberry juice	2.474
Cherries, sour	2.205
Wine, red	2.199
Power Bar, chocolate flavor ²	1.875
Pineapple juice	1.859
Latino beverages, guava nectar	1.858
Juice drinks, 10% juice, blueberry or strawberry flavor, vitamin C-enriched	1.821
Cranapple juice	1.790
Prunes	1.715
Chocolates, dark, sugar-free	1.675
Cabbage, red cooked	1.614
Orange juice	1.510
Apple juice, with added vitamin C	1.462
Latino beverages, mango nectar	1.281
Pineapple	1.276
Oranges	1.261
Bran Flakes, breakfast cereals ³	1.244
Plums, black	1.205
Pinto beans, dried	1.137
Canned chili with meat and beans	1.049
Spinach, frozen	1.045
Canned chili with meat, no beans	1.040
Whole Grain Total, breakfast cereal ⁴	1.024
Chocolate, sugar-free	1.001
Kiwi fruit	0.987
Molasses, dark	0.980
Potatoes, red, cooked	0.956
Cheese lasagna, frozen and cooked	0.942
Potatoes, white, cooked	0.918
Sweet potatoes, baked	0.900
Iced tea, brewed, unsweetened	0.881
Potatoes, russet, cooked	0.862
Baked beans, pork and beans in brown sugar sauce	0.852
Condensed tomato soup, one brand	0.826
Broccoli raab, cooked	0.823
Peppers, red, cooked	0.820
Broccoli, cooked	0.780
Latino beverages, tamarind nectar	0.761

¹ The antioxidant content per serving size was calculated as indicated in Table 6. Mean values are provided for products for which different brands are comparable.

² POWERBAR Co, Berkeley, CA.

³ Ralston Foods, Battle Creek, MI.

⁴ General Mills, Inc, Milwaukee, WI.

TABLE 5

Effects of processing on the antioxidant contents of foods

Product	Type of processing	Antioxidant content <i>% of nonprocessed food</i>
Carrots	Microwave cooking	113–143 ¹
Spinach	Microwave cooking	103–121
Mushrooms	Microwave cooking	113
Corn grits	Microwave cooking	21–32
Asparagus	Cooking by steaming	205
Broccoli	Cooking by steaming	122–654
Cabbage	Cooking by steaming	448
Red cabbage	Cooking by steaming	270
Carrots	Cooking by steaming	291
Green pepper	Cooking by steaming	467
Red pepper	Cooking by steaming	180
Potatoes	Cooking by steaming	105–242
Tomatoes	Cooking by steaming	112–164
White rice	Cooking by steaming	33–70
Spaghetti	Cooking by steaming	42–63
Carrots	Boiling	121–159
Corn grits	Boiling	27–29
Spinach	Boiling	84–114
Sweet potatoes	Boiling	413
Bagels	Toasting	134–367
French bread	Toasting	177
Wheat bread	Toasting	153–185
Whole-wheat bread	Toasting	184–214
Pie crust	Baking	311–1450

¹ Range (all such values).

>1 mmol/100 g, whereas most of the samples (672 food products) contained between 0.1 and 1.0 mmol/100 g. Many samples contained <0.1 mmol/100 g (329 food products).

There was a strong asymmetric distribution of plant and animal food products in the ranked antioxidant content list. In general, plants and plant products in the diet have a much higher antioxidant content than do animal food products. Almost all of the 300 products containing the most antioxidants were pure plant-derived products, whereas almost all of the 300 products with the lowest antioxidant contents were animal-derived products.

There are many interesting features of the antioxidant values presented in Table 6. For example, there are large variations in the antioxidant values for diluted fruit drinks. Most had a low antioxidant value, but some that were enriched with ascorbic acid were among the foods with highest antioxidant values. This was also the case for some other foods, such as fortified cereals or foods containing additives such as butylated hydroxyanisole or butylated hydroxytoluene. Interestingly, many plant foods containing high amounts of unsaturated fatty acids had high antioxidant values (eg, walnuts), whereas fish that also contain high amount of unsaturated fatty acids had low antioxidant values. Additionally, processed foods such as lasagna, pudding mix, and chocolate chip cookies were among the 50 foods with the highest antioxidant contents, and chocolate ice cream had a higher antioxidant value than did some fruits (eg, honeydew and green grapes).

Antioxidant values based on serving size are also shown in Table 6. There was also a strong asymmetric distribution of products in the ranked antioxidant content per serving size. Of the 1120 food products analyzed, 87 products contained >1 mmol/

TABLE 6The total antioxidant content of 1120 food samples from the US Department of Agriculture (USDA) National Food and Nutrient Analysis Program (NFNAP)¹

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g			g	mmol/serving
Berries and berry products								
Blackberries		NS	3	4.023	0.443	144	1 cup	5.794
Blackberries, fresh frozen	Local grocery	L	1	4.059	—	144	1 cup	5.845
Blackberries, fresh frozen	Wholesaler	L	1	3.889	—	144	1 cup	5.600
Blueberries		NS	8	1.854	0.396	145	1 cup	2.688
Blueberries, canned, heavy syrup, drained liquid	S&W	NS	1	2.529	—	118		2.984
Blueberries, canned, heavy syrup, drained solids	S&W	NS	1	2.794	—	122		3.409
Blueberries, canned, light syrup, drained liquid	Oregon	NS	3	1.654	0.231	118		1.951
Blueberries, canned, light syrup, drained solids	Oregon	NS	3	1.939	0.554	122	0.5 cup	2.366
Cranberries		NS	4	3.289	0.178	95	1 cup whole	3.125
Cranberry juice cocktail	Ocean Spray	NS	1	0.978	—	253	8 oz (240 mL)	2.474
Raspberries		NS	6	2.334	0.518	123	1 cup	2.870
Strawberries		NS	8	2.159	0.298	166	1 cup sliced	3.584
Beverages								
Beer, light	Mixed brands	NS	1	0.102	—	356	1 can (12 fl oz)	0.362
Beer, light	Bud Light	NS	1	0.078	—	354	1 can (1 fl oz)	0.276
Beer, light	Coors Light	NS	1	0.064	—	354	1 can (12 fl oz)	0.228
Beer, light	Miller Light	NS	1	0.092	—	354	1 can (12 fl oz)	0.324
Beer, light	Natural Light	NS	1	0.103	—	354	1 can (12 fl oz)	0.364
Beer, regular	Mixed brands	NS	1	0.137	—	356	1 can (12 fl oz)	0.489
Beer, regular	Budweiser	NS	1	0.148	—	356	1 can (12 fl oz)	0.528
Beer, regular	Busch	NS	1	0.121	—	356	1 can (12 fl oz)	0.430
Beer, regular	Miller High Life	NS	1	0.123	—	356	1 can (1 fl oz)	0.439
Cola, regular	Coca-Cola Classic	NS	2	0.046	0.042–0.050	246	8 oz (240 mL)	0.113
Cola, diet	Coke	NS	1	0.042	—	237	8 oz (240 mL)	0.100
Cola, diet	Pepsi	NS	2	0.039	0.031–0.047	237	8 oz (240 mL)	0.092
Cola, regular	Pepsi	NS	2	0.042	0.039–0.044	246	8 oz (240 mL)	0.102
Cola, diet	Pepsi One	NS	1	0.064	—	237	8 oz (240 mL)	0.151
Juice drinks, 10% juice, mountain cooler flavor	Capri Sun	NS	1	0.017	—	248	8 oz (240 mL)	0.043
Juice drinks, 10% juice, sun splash cooler flavor	Capri Sun	NS	1	0.031	—	248	8 oz (240 mL)	0.077
Juice drinks, 10% juice, strawberry flavor	Capri Sun	NS	1	0.056	—	248	8 oz (240 mL)	0.138
Juice drinks, 10% juice, strawberry kiwi flavor	Capri Sun	NS	1	0.046	—	248	9 oz (240 mL)	0.114
Juice drinks, 10% juice, blazin' blueberry flavor	Hi-C	NS	1	0.734	—	248	8 oz (240 mL)	1.821
Juice drinks, 10% juice, boppin's strawberry flavor	Hi-C	NS	1	0.724	—	248	8 oz (240 mL)	1.795
Latino beverages, guanabana nectar	Goya	NS	1	0.213	—	223	1 cup	0.475
Latino beverages, mango nectar	Goya	NS	1	0.203	—	216	1 cup	0.438
Latino beverages, tamarind (tamarindo) nectar	Goya	NS	1	0.159	—	215	1 cup	0.342
Latino beverages, guanabana nectar	Other brand	NS	1	0.282	—	212	1 cup	0.598
Latino beverages, guava (guayaba) nectar	Other brand	NS	1	0.872	—	213	1 cup	1.858
Latino beverages, mango nectar	Other brand	NS	1	0.604	—	212	1 cup	1.281
Latino beverages, tamarind (tamarindo) nectar	Other brand	NS	1	0.357	—	213	1 cup	0.761

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g			mmol/serving	
Lemonade mix, pink, sweetened with artificial sweetener	Crystal Light	NS	1	0.000	—	1.8	amount to make 8 oz (240 mL)	0.000
Lemonade mix, sweetened with artificial sweetener	Crystal Light	NS	1	0.000	—	2.1	amount to make 8 oz (240 mL)	0.000
Lemonade, pink, frozen concentrate	Minute Maid	NS	1	0.431	—	73	2 oz (amount to make 8 oz reconstituted)	0.315
Lemonade, pink, frozen concentrate	Other brand	NS	1	0.458	—	73	2 oz (amount to make 8 oz reconstituted)	0.335
Lemonade mix, pink, sweetened with sugar	Country Time	NS	1	0.774	—	27	2 tbsp	0.209
Lemonade mix, sweetened with sugar	Country Time	NS	1	0.845	—	27	2 tbsp	0.228
Lemonade mix, sweetened with sugar	Kool-Aid	NS	1	0.608	—	27	2 tbsp	0.164
Lemonade, regular, frozen concentrate	Minute Maid	NS	1	0.373	—	73	2 oz (amount to make 8 oz reconstituted)	0.272
Lemonade, regular, frozen concentrate	Store brand	NS	1	0.451	—	73	2 oz (amount to make 8 oz reconstituted)	0.329
Lemon-lime soda, regular	Sprite	NS	1	0.004	—	246	8 oz (240 mL)	0.010
Noncarbonated bottled drinking water	Aquafina	NS	1	0.000	—	240	8 oz (240 mL)	0.000
Noncarbonated bottled drinking water	Dannon	NS	2	0.002	0.002–0.002	240	8 oz (240 mL)	0.004
Noncarbonated bottled drinking water	Dasani	NS	1	0.000	—	240	8 oz (240 mL)	0.001
Noncarbonated bottled drinking water	Evian	NS	2	0.000	0.000–0.000	240	8 oz (240 mL)	0.000
Noncarbonated bottled drinking water	Calistoga	NS	1	0.000	—	240	240 mL	0.000
Noncarbonated bottled drinking water	Crystal Geyser	NS	1	0.000	—	240	240 mL	0.001
Noncarbonated bottled drinking water	Dannon	NS	1	0.002	—	240	240 mL	0.004
Noncarbonated bottled drinking water	Evian	NS	1	0.000	—	240	240 mL	0.001
Noncarbonated bottled drinking water	Naya	NS	1	0.000	—	240	240 mL	0.001
Noncarbonated bottled drinking water	Store brand	NS	1	0.002	—	240	240 mL	0.004
Noncarbonated flavored bottled drinking water, essential multivitamin, watermelon flavor	Aquafina	NS	1	0.021	—	240	8 oz (240 mL)	0.049
Noncarbonated flavored bottled drinking water, fluoride to go	Dannon	NS	1	0.000	—	240	8 oz (240 mL)	0.000
Noncarbonated flavored bottled drinking water, fitness H ₂ O, natural lemon flavor	Propel	NS	1	0.112	—	240	8 oz (240 mL)	0.269
Noncarbonated flavored bottled drinking water, elements enhanced water energy, lemon	Snapple	NS	1	0.072	—	240	8 oz (240 mL)	0.172

(Continued)



TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g		g		mmol/serving
Noncarbonated flavored bottled drinking water, fruit ₂ O, natural raspberry flavor	Veryfine	NS	1	0.000	—	240	8 oz (240 mL)	0.000
Noncarbonated flavored bottled drinking water, fruit ₂ O water, natural strawberry flavor	Veryfine	NS	1	0.000	—	240	8 oz (240 mL)	0.000
Energy drink	Red Bull	NS	1	0.000	—	250	1 can	0.000
Energy drink, sugar-free	Red Bull	NS	1	0.000	—	263	1 can	0.000
Sports drink, orange flavor	Gatorade	NS	1	0.003	—	241	8 oz (240 mL)	0.007
Sports drink, lemon-lime flavor	Powerade	NS	1	0.007	—	241	8 oz (240 mL)	0.017
Sports drink mix, orange flavor	Gatorade	NS	1	0.008	—	16	0.75 scoop (to make 8 oz)	0.001
Tea, instant, dry powder, with lemon and sugar	Lipton	NS	1	0.938	—	23	1 serving (1 tbsp)	0.216
Tea, ready-to-drink, iced tea with lemon flavor	Arizona	NS	1	0.162	—	240	8 oz (240 mL)	0.389
Tea, ready-to-drink, natural lemon iced tea	Nestea	NS	1	0.054	—	240	8 oz (240 mL)	0.131
Tea, ready-to-drink, brisk lemon iced tea	Lipton	NS	2	0.051	0.048–0.053	240	8 oz (240 mL)	0.121
Lemonade mix, unsweetened	Kool-Aid	NS	1	12.750	—	0.9	amount to make 8 oz (240 mL)	0.115
Wine, red (Merlot)	Franzia	NS	1	2.135	—	103	1 glass (3.5 fl oz)	2.199
Wine, white (Chardonnay)	Franzia	NS	1	0.161	—	103	1 glass (3.5 fl oz)	0.166
Ready-to-eat cereals								
100% natural granola, oats, honey, and raisins	Quaker	NS	1	0.157	—	51	weight of 1 NLEA serving, per SR17	0.080
All Brans	Kellogg's	S	1	1.559	—	30	weight of NLEA serving, per SR17	0.468
Bran Flakes	Ralston	S	3	4.291	0.104	29	1 NLEA serving (0.75 cup)	1.244
Cap'n Crunch Peanut Butter Cereal	Quaker	NS	1	0.527	—	27	weight of 1 NLEA serving, per SR17	0.142
Cheerios	General Mills	S	1	1.117	—	30	weight of 1 NLEA serving, per SR17	0.335
Cocoa Krispies	Kellogg's	NS	1	1.558	—	31	weight of 1 NLEA serving, per SR17	0.483
Corn and Rice, Crispix	Kellogg's	NS	2	1.128	1.063–1.192	29	1 NLEA serving (0.75 cup)	0.327
Corn and Rice, Crispy Doubles	Giant Eagle	S	1	0.724	—	29	1 NLEA serving (0.75 cup)	0.210
Corn and Rice, Crispy Hexagons	Shop 'N Save	S	1	0.775	—	29	1 NLEA serving (0.75 cup)	0.225
Corn and Rice, Crispy Hexagons	Price Chopper	S	1	0.879	—	29	1 NLEA serving (0.75 cup)	0.255
Corn Flakes	Kellogg's	NS	1	1.276	—	28	weight of 1 NLEA serving, per SR17	0.357
Corn Flakes	Ralston	S	3	1.234	0.032	28	1 NLEA serving (1 cup)	0.346
Corn squares, corn biscuits	Ralston	S	2	0.460	0.450–0.470	30	1 NLEA serving (1 cup)	0.138
Corn squares, toasted corn	Price Chopper	S	1	0.505	—	30	1 NLEA serving (1 cup)	0.151
Froot Loops	Kellogg's	NS	1	0.895	—	30	weight of 1 NLEA serving, per SR17	0.269
Oat circles	Ralston	NS	3	0.836	0.083	30	1 NLEA serving (1 cup)	0.251
Original Shredded Wheat	Post	NS	1	0.227	—	49	weight of 1 NLEA serving, per SR17	0.111

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g			mmol/serving	
Raisin Bran	Post	NS	1	0.770	—	59	weight of 1 NLEA serving, per SR17	0.454
Rice Krispies	Kellogg's	NS	3	0.858	0.131	33	1 NLEA serving (1.25 cup)	0.283
Rice Crisp	Ralston	NS	3	1.022	0.038	33	1 NLEA serving (1.25 cup)	0.337
Rice Krispies	Kellogg's	S	1	1.118	—	33	weight of 1 NLEA serving, per SR17	0.369
Uncle Sam Cereal	U.S. Mills	S	1	1.121	—	55	weight of 1 NLEA serving, per SR17	0.616
Whole Grain Total	General Mills	S	1	3.412	—	30	weight of 1 NLEA serving, per SR17	1.024
Dairy products								
American cheese, pasteurized process cheese food	Kraft Singles	S	2	0.056	0.052–0.060	28.35		0.016
American cheese, pasteurized process cheese food	Store brand	NS	3	0.062	0.024	28.35		0.018
American cheese, pasteurized process cheese food	Kraft Deluxe	NS	1	0.036		28.35		0.010
Cheddar cheese, chunk	Store brand	NS	1	0.062		28.35	1 oz	0.017
Cheddar cheese, chunk	Kraft	S	1	0.094		28.35	1 oz	0.027
Cheese, American, skim, white, sliced, commodity	Land O Lakes	S	1	0.032		28.35	1 oz	0.009
Cheese, American, skim, yellow, sliced	Schreiber	S	3	0.039	0.007	28.35	1 oz	0.011
Cheese, American, skim, yellow, sliced commodity	Land O Lakes	S	3	0.039	0.009	28.35	1 oz	0.011
Cheese, processed, commodity	Land O Lakes	S	6	0.055	0.011	28.35	1 oz	0.016
Cheese, processed, white, sliced	AMPI	S	3	0.035	0.005	28.35	1 oz	0.010
Cheese, processed, yellow, sliced, commodity	Bongards	S	3	0.042	0.001	28.35	1 oz	0.012
Cheese, processed, yellow, sliced, commodity	Land O Lakes	S	3	0.048	0.011	28.35	1 oz	0.014
Ice cream, chocolate, regular fat	Breyers	NS	1	0.763	—	66	0.5 cup (weight per SR17)	0.504
Ice cream, chocolate, regular fat	Store brand	NS	1	0.500	—	66	0.5 cup (weight per SR17)	0.330
Ice cream, chocolate, regular fat, grand chocolate flavor	Edy's/Dreyers	NS	1	0.711	—	66	0.5 cup (weight per SR17)	0.469
Ice cream, vanilla, regular fat	Store brand	NS	1	0.059	—	72	0.5 cup (weight per SR17)	0.043
Ice cream, vanilla, regular fat	Other brand	NS	1	0.071	—	72	0.5 cup (weight per SR17)	0.051
Ice cream, vanilla, regular fat, natural vanilla	Edy's/Dreyers	NS	1	0.053	—	72	0.5 cup (weight per SR17)	0.038
Ice cream, vanilla, regular fat, natural vanilla	Breyers	NS	1	0.059	—	72	0.5 cup (weight per SR17)	0.042
Milk, 1%	Store brand	NS	4	0.051	0.022	245	240 mL (8 oz)	0.125
Milk, 2%	Store brand	NS	4	0.042	0.010	245	240 mL (8 oz)	0.103
Milk, chocolate, 2% reduced-fat	Store brand	NS	1	0.139	—	250	8 oz (240 mL)	0.347
Milk, chocolate, 2% reduced-fat milk	Hershey's	NS	1	0.175	—	250	8 oz (240 mL)	0.437
Milk, skim	Store brand	NS	5	0.041	0.004	245	240 mL (8 oz)	0.101

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g		g		mmol/serving
Mozzarella cheese, low-moisture part-skim	Store brand	NS	2	0.059	0.023–0.095	28.35	1 oz	0.017
Mozzarella cheese, low-moisture part-skim	Kraft	NS	1	0.044	—	28.35	1 oz	0.013
Mozzarella cheese, whole-milk	Store brand	NS	1	0.064	—	28.35	1 oz	0.018
Mozzarella cheese, whole-milk	Polly-O	NS	1	0.095	—	28.35	1 oz	0.027
Mozzarella cheese, whole-milk	Sorrento	NS	1	0.107	—	28.35	1 oz	0.030
Mozzarella cheese, whole-milk	Precious	NS	1	0.116	—	28.35	1 oz	0.033
Parmesan cheese, grated	Kraft	NS	4	0.063	0.005	5		0.003
Parmesan cheese, grated	Store brand	NS	2	0.102	0.100–0.103	5		0.005
Sour cream	Breakstone	NS	1	0.011	—	12	1 tbsp	0.001
Sour cream	Store brand	NS	1	0.055	—	12	1 tbsp	0.007
Sour cream	Other brand	NS	1	0.032	—	12	1 tbsp	0.004
Swiss cheese slices	Store brand	NS	3	0.080	0.023	28.35	1 oz	0.023
Swiss cheese slices	Kraft	NS	3	0.074	0.006	28.35	1 oz	0.021
Yogurt	Store brand	NS	1	0.039	—	227	1 container (8 oz)	0.090
Yogurt, 99% fat-free, strawberry	Yoplait	NS	1	0.109	—	227	1 container (8 oz)	0.248
Yogurt, frozen, chocolate	Other brand	NS	1	0.451	—	87	0.5 cup	0.392
Yogurt, frozen, fat-free, vanilla	Edy's/Dreyers	NS	1	0.057	—	87	0.5 cup	0.049
Yogurt, frozen, vanilla	Other brand	NS	1	0.047	—	87	0.5 cup	0.041
Yogurt, strawberry, fruit on the bottom	Dannon	NS	1	0.131	—	227	1 container (8 oz)	0.297
Desserts and cakes								
Blueberry muffins	Store brand	NS	1	0.459	—	113	1 medium muffin	0.518
Blueberry muffins, mini muffins	Hostess	NS	1	0.367	—	119	7 mini muffins	0.437
Buttermilk pancakes, frozen	Hungry Jack	NS	1	0.227	—	76	two 4-in pancakes	0.172
Buttermilk pancakes, frozen	Eggo	NS	1	0.137	—	76	two 4-in pancakes	0.104
Buttermilk pancakes, frozen, microwaved	Hungry Jack	NS	2	0.173	0.149–0.197	76	two 4-in pancakes	0.131
Buttermilk pancakes, frozen, microwaved	Eggo	NS	1	0.104	—	76	two 4-in pancakes	0.079
Buttermilk pancakes, frozen, microwaved	Aunt Jemima	NS	1	0.075	—	76	two 4-in pancreas	0.057
Buttermilk pancakes, frozen, toasted	Hungry Jack	NS	1	0.272	—	76	two 4-in pancakes	0.206
Buttermilk pancakes, frozen, toasted	Eggo	NS	1	0.126	—	76	two 4-in pancakes	0.096
Buttermilk waffles, frozen	Eggo	NS	1	0.080	—	70	1 serving	0.056
Buttermilk waffles, frozen	Aunt Jemima	NS	1	0.122	—	70	1 serving	0.086
Buttermilk waffles, frozen, microwaved	Eggo	NS	1	0.071	—	70	1 serving	0.050
Buttermilk waffles, frozen, microwaved	Aunt Jemima	NS	1	0.119	—	70	1 serving	0.083
Buttermilk waffles, frozen, toasted	Eggo	NS	2	0.108	0.108–0.108	70	1 serving	0.076
Buttermilk waffles, frozen, toasted	Downyflake	NS	1	0.156	—	70	1 serving	0.110
Buttermilk waffles, frozen, toasted	Store brand	NS	1	0.201	—	70	1 serving	0.141
Buttermilk waffles, frozen, toasted	Hungry Jack	NS	1	0.202	—	70	1 serving	0.142

(Continued)



TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g		g		mmol/serving
Cake frosting, vanilla, ready-to-spread	Duncan Hines Creamy Homestyle	NS	2	0.040	0.035–0.044	41	2 tbsp	0.016
Cake frosting, chocolate, ready-to-spread, creamy chocolate	Pillsbury	NS	1	0.803	—	41	2 tbsp	0.329
Cake frosting, chocolate, ready-to-spread, creamy milk chocolate	Pillsbury	NS	1	1.088	—	41	2 tbsp	0.446
Cake frosting, chocolate, ready-to-spread, homestyle milk chocolate	Duncan Hines Homestyle	NS	1	1.009	—	41	2 tbsp	0.414
Cake frosting, ready-to-spread homestyle classic chocolate	Duncan Hines Homestyle Classic	NS	1	0.919	—	41	2 tbsp	0.377
Cake frosting, vanilla, ready-to-spread	Pillsbury Creamy	NS	2	0.087	0.086–0.087	41	2 tbsp	0.035
Cake frosting, vanilla, ready-to-spread	Betty Crocker Rich & Creamy	NS	2	0.153	0.150–0.156	41	2 tbsp	0.063
Cake frosting, chocolate, ready-to-spread	Betty Crocker Rich & Creamy	NS	2	0.807	0.715–0.899	41	2 tbsp	0.331
Chocolate chip cookies	Chips Ahoy	NS	2	1.722	1.699–1.745	30	3 medium cookies	0.517
Chocolate chip cookies	Store brand	NS	1	1.287	—	30	3 medium cookies	0.386
Chocolate chip cookies	Chips Deluxe	NS	1	1.004	—	30	3 medium cookies	0.301
Chocolate chip cookies	Entenmann's	NS	1	1.376	—	30	3 medium cookies	0.413
Chocolate chip cookies	Chunky Chips Ahoy	NS	1	2.231	—	30	3 medium cookies	0.669
Chocolate cookies with vanilla creme filling	Oreo	NS	3	1.840	0.029	30	3 medium cookies	0.552
Chocolate cookies with vanilla creme filling	Oreo Double Stuf	NS	2	1.545	1.445–1.644	30	3 medium cookies	0.463
Chocolate cookies with vanilla creme filling	Store brand	NS	1	1.556	—	30	3 medium cookies	0.467
Chocolate devils food cake mix, prepared	Betty Crocker Super Moist	NS	2	0.428	0.409–0.447	95	1/12 of 9-in diameter cake	0.407
Chocolate devils food cake mix, prepared	Duncan Hines Moist Deluxe	NS	2	0.380	0.326–0.434	95	1/12 of 9-in diameter cake	0.361
Chocolate devils food cake mix, prepared	Pillsbury Moist Supreme	NS	2	0.609	0.467–0.750	95	1/12 of 9-in diameter cake	0.578
Chocolate devils food cake mix, unprepared	Betty Crocker Super Moist	NS	2	0.686	0.661–0.711	43	1/12 of mix to make 1 whole cake	0.295
Chocolate devils food cake mix, unprepared	Pillsbury Moist Supreme	NS	2	0.985	0.959–1.010	44	1/12 of mix to make 1 whole cake	0.433
Chocolate devils food cake mix, unprepared	Duncan Hines Moist Deluxe	NS	2	0.905	0.889–0.920	43	1/12 of mix to make 1 whole cake	0.389
Cupcakes, chocolate	Hostess	NS	1	1.146	—	50	1 cupcake	0.573
Cupcakes, chocolate	Little Debbie	NS	2	0.972	—	50	1 cupcake	0.486
Doughnuts, cake, chocolate covered	Store brand	NS	1	0.287	—	43	1 serving	0.123
Doughnuts, cake, chocolate covered	Hostess, Donettes	NS	1	0.865	—	43	1 serving	0.372
Doughnuts, cake, plain	Store bakery or prepackaged	NS	1	0.145	—	45	1 doughnut	0.065
Doughnuts, glazed, plain	Krispy Kreme	NS	1	0.161	—	60	1 serving	0.096
Doughnuts, glazed, plain	Store brand	NS	1	0.183	—	60	1 serving	0.110
Doughnuts, mini-cake-type with powdered sugar	Hostess Donettes	NS	1	0.111	—	45	1 serving	0.050
English muffins, plain, toasted	Store brand	NS	1	0.158	—	52	1 muffin	0.082
Gelatin, prepared, snack, strawberry flavor	Hunts Juicy Gels	NS	1	0.026	—	135	0.5 cup	0.035

(Continued)



TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g		g		mmol/serving
Gelatin, prepared, snack, strawberry flavor	Jell-O	NS	1	0.000	—	135	0.5 cup	0.000
Gelatin, prepared, snack, strawberry orange flavor	Hunts Juicy Gels	NS	1	0.008	—	135	0.5 cup	0.011
Gelatin, prepared, snack, strawberry orange flavor	Jell-O	NS	1	0.005	—	135	0.5 cup	0.007
Ice-type novelties, containing fruit juice	Popsicle Scribblers	NS	1	0.104	—	88	1 single stick	0.092
Ice-type novelties, regular, grape flavor	Popsicle Ice Bar	NS	1	0.012	—	88	1 single stick	0.011
Ice-type novelties, regular, cherry flavor	Popsicle Ice Bar	NS	1	0.006	—	88	1 single stick	0.006
Ice-type novelties, regular, orange flavor	Popsicle Ice Bar	NS	1	0.006	—	88	1 single stick	0.006
Ice-type novelties, sugar free, cherry flavor	Popsicle Ice Bar	NS	1	0.089	—	88	1 single stick	0.078
Ice-type novelties, sugar free, grape flavor	Popsicle Ice Bar	NS	1	0.087	—	88	1 single stick	0.077
Ice-type novelties, sugar free, orange flavor	Popsicle Ice Bar	NS	1	0.089	—	88	1 single stick	0.078
Pie crust, frozen deep dish, regular fat	Marie Callender's	NS	1	0.012	—	18	1/8 of 9-in crust	0.002
Pie crust, frozen deep dish, regular fat	Pillsbury Pet-Ritz	NS	1	0.053	—	18	1/8 of 9-in crust	0.010
Pie crust, frozen deep dish, regular fat	Store brand	NS	1	0.049	—	18	1/8 of 9-in crust	0.009
Pie crust, frozen deep dish, regular fat, baked	Marie Callender's	NS	1	0.174	—	16	1/8 of 9-in crust	0.028
Pie crust, frozen deep dish, regular fat, baked	Pillsbury Pet-Ritz	NS	1	0.212	—	16	1/8 of 9-in crust	0.034
Pie crust, frozen deep dish, regular fat, baked	Store brand	NS	1	0.154	—	16	1/8 of 9-in crust	0.025
Pie crust, frozen, regular fat	Store brand	NS	1	0.077	—	18	1/8 of 9-in crust	0.014
Pie crust, frozen, regular fat, baked	Store brand	NS	1	0.306	—	16	1/8 of 9-in crust	0.049
Pudding mix, chocolate, cook and serve	Jell-O	NS	1	2.238	—	15	amount to make 0.5 cup	0.560
Pudding mix, chocolate, sugar free cook and serve	Jell-O	NS	1	4.097	—	10	amount to make 0.5 cup	0.410
Pudding mix, chocolate, sugar-free, fat-free, instant	Jell-O	NS	1	2.743	—	11	amount to make 0.5 cup	0.302
Pudding mix, vanilla, cook and serve	Jell-O	NS	1	0.136	—	22	amount to make 0.5 cup	0.030
Pudding mix, vanilla, instant	Jell-O	NS	1	0.127	—	25	amount to make 0.5 cup	0.032
Pudding mix, vanilla, sugar free, cook and serve	Jell-O	NS	1	0.752	—	6	amount to make 0.5 cup	0.045
Pudding mix, vanilla, sugar-free, fat-free, instant	Jell-O	NS	1	0.369	—	8	amount to make 0.5 cup	0.029
Pudding, Handi Snacks, vanilla flavor	Kraft	NS	1	0.047	—	113	0.5 cup	0.053
Pudding, Handi Snacks, chocolate flavor	Kraft	NS	1	0.405	—	113	0.5 cup	0.458
Pudding, refrigerated, chocolate flavor	Swiss Miss	NS	1	0.307	—	113	1 NLEA serving	0.346
Pudding, refrigerated, fat-free pudding snacks, tapioca flavor	Jell-O	NS	1	0.076	—	113	1 NLEA serving	0.086

(Continued)



TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g		g		mmol/serving
Pudding, refrigerated, pudding snacks, chocolate flavor	Jell-O	NS	1	0.400	—	113	1 NLEA serving	0.452
Pudding, refrigerated, pudding snacks, vanilla flavor	Jell-O	NS	1	0.023	—	113	1 NLEA serving	0.027
Pudding, refrigerated, vanilla flavor	Swiss Miss	NS	1	0.061	—	113	1 NLEA serving	0.069
Pudding, refrigerated, tapioca flavor	Swiss Miss	NS	1	0.039	—	113	1 NLEA serving	0.044
Pudding, snack pack, chocolate flavor	Hunts	NS	1	0.261	—	113	0.5 cup	0.295
Pudding, snack pack, vanilla flavor	Hunts	NS	1	0.063	—	113	0.5 cup	0.071
Pudding, snack pack, tapioca flavor	Hunts	NS	1	0.031	—	113	0.5 cup	0.035
Toaster pastries, strawberry, frosted	Kelloggs Pop Tarts	NS	1	0.145	—	52	1 pastry	0.076
Toaster pastries, strawberry, frosted	Store brand	NS	1	0.182	—	52	1 pastry	0.095
Toaster pastries, strawberry, frosted, toasted	Kelloggs Pop Tarts	NS	1	0.283	—	52	1 pastry	0.147
Toaster pastries, strawberry, frosted, toasted	Store brand	NS	1	0.282	—	52	1 pastry	0.147
Toaster pastries, strawberry, plain (not frosted)	Kelloggs Pop Tarts	NS	1	0.157	—	52	1 pastry	0.082
Toaster pastries, strawberry, plain (not frosted)	Store brand	NS	1	0.174	—	52	1 pastry	0.090
Toaster pastries, strawberry, plain (not frosted), toasted	Kelloggs Pop Tarts	NS	1	0.271	—	52	1 pastry	0.141
Toaster pastries, strawberry, plain (not frosted), toasted	Store brand	NS	1	0.308	—	52	1 pastry	0.160
Waffles, regular, frozen	Eggo	NS	1	0.070	—	70	1 serving	0.049
Waffles, regular, frozen	Store brand	NS	1	0.095	—	70	1 serving	0.067
Waffles, regular, frozen, microwaved	Eggo	NS	1	0.057	—	70	1 serving	0.040
Waffles, regular, frozen, microwaved	Store brand	NS	1	0.086	—	70	1 serving	0.060
Waffles, regular, frozen, toasted	Eggo	NS	3	0.105	0.024	70	1 serving	0.074
Waffles, regular, frozen, toasted	Store brand	NS	1	0.166	—	70	1 serving	0.116
Waffles, regular, frozen, toasted	Downyflake	NS	1	0.163	—	70	1 serving	0.114
Waffles, regular, frozen, toasted	Aunt Jemima	NS	1	0.168	—	70	1 serving	0.118
Eggs								
Eggs, whites	Store brand	NS	5	0.009	0.003	33	1 large	0.003
Eggs, yolk	Store brand	NS	5	0.020	0.005	17	1 large	0.003
Whole eggs	Store brand	NS	1	0.039	—	50	1 large	0.019
Whole eggs	Store brand	NS	5	0.024	0.004	50	1 large	0.012
Whole eggs, fried	Store brand	NS	5	0.047	0.006	46	1 large	0.022
Whole eggs, hard cooked	Store brand	NS	5	0.038	0.002	50	1 large	0.019
Fast foods								
1/4 lb Single hamburger with cheese	Wendy's	NS	1	0.116	—	21	1 sandwich	0.254

(Continued)



TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g		g		mmol/serving
1/4 lb Single hamburger, no cheese	Wendy's	NS	4	0.123	0.013	200	1 sandwich	0.246
Bacon egg and cheese biscuit	McDonald's	NS	4	0.100	0.025	142	1 sandwich	0.142
Bean burrito	Taco Bell	NS	4	0.162	0.032	201	1 burrito	0.326
Big Mac, national	McDonald's	NS	1	0.076	-	207	1 sandwich	0.158
Big Mac, no cheese, national	McDonald's	NS	1	0.089	-	189	1 sandwich	0.167
BK big fish with cheese	Burger King	NS	1	0.089	-	276	1 sandwich	0.246
BK broiler	Burger King	NS	1	0.107	-	256	1 sandwich	0.274
Breast fillet	Wendy's	NS	1	0.124	-	193	1 sandwich	0.240
Burrito supreme with beef	Taco Bell	NS	4	0.124	0.007	248	1 burrito	0.308
Burrito supreme with chicken	Taco Bell	NS	4	0.129	0.006	263	1 burrito	0.340
Burrito supreme with steak	Taco Bell	NS	4	0.124	0.017	247	1 burrito	0.307
Cheese pizza, regular crust	Pizza Hut	NS	4	0.183	0.032	97	1 slice of 12-in diameter pizza	0.178
Cheese pizza, thick crust	Pizza Hut	NS	4	0.165	0.015	100	1 slice of 12-in diameter pizza	0.165
Cheese pizza, thin crust	Pizza Hut	NS	4	0.201	0.026	69	1 slice of 12-in diameter pizza	0.139
Cheeseburger	Burger King	NS	1	0.152	-	121	1 sandwich	0.184
Cheeseburger, national	McDonald's	NS	1	0.110	-	112	1 sandwich	0.123
Chicken McGrill, national	McDonald's	NS	1	0.067	-	200	1 sandwich	0.134
Chicken McNuggets	McDonald's	NS	4	0.198	0.018	100	1 medium serving	0.198
Chicken nuggets	Wendy's	NS	4	0.250	0.039	70	1 medium serving	0.175
Chicken sandwich	Burger King	NS	1	0.173	-	204	1 sandwich	0.353
Chicken tenders	Burger King	NS	4	0.116	0.005	114	1 medium serving	0.132
Cini-minis	Burger King	NS	4	0.606	0.111	102	4 pieces	0.618
Classic double with cheese	Wendy's	NS	1	0.069	-	287	1 sandwich	0.198
Classic hand-tossed pizza, cheese	Domino's	NS	4	0.200	0.020	106	1 slice of 14-in diameter pizza	0.211
Classic hand-tossed pizza, pepperoni	Domino's	NS	4	0.208	0.036	120	1 slice of 14-in diameter pizza	0.249
Classic hand-tossed pizza, extravaganza feast	Domino's	NS	4	0.176	0.034	151	1 slice of 14-in diameter pizza	0.266
Coffee	Wendy's	NS	1	1.235	-	237	8 oz (240 mL)	2.927
Coffee	Burger King	NS	1	1.262	-	237	8 oz (240 mL)	2.991
Crispy chicken sandwich	McDonald's	NS	1	0.176	-	201	1 sandwich	0.355
Croissan'wich with egg and cheese	Burger King	NS	4	0.145	0.011	127	1 sandwich	0.184
Croissan'wich with sausage and cheese	Burger King	NS	4	0.210	0.030	115	1 sandwich	0.242
Croissan'wich with sausage egg and cheese	Burger King	NS	4	0.156	0.011	162	1 sandwich	0.252
Crunchy taco	Taco Bell	NS	4	0.238	0.025	72	1 taco	0.171
Double Whopper	Burger King	NS	1	0.066	-	340	1 sandwich	0.224
Double Whopper with cheese	Burger King	NS	1	0.043	-	365	1 sandwich	0.155
Egg McMuffin	McDonald's	NS	4	0.089	0.003	131	1 sandwich	0.116
Eggwich with bacon and cheese	Burger King	NS	4	0.061	0.017	123	1 sandwich	0.075
Eggwich with bacon egg and cheese	Burger King	NS	4	0.076	0.015	134	1 sandwich	0.102
Eggwich with egg and cheese	Burger King	NS	4	0.060	0.009	123	1 sandwich	0.073
Filet-o-Fish	McDonald's	NS	1	0.132	-	152	1 sandwich	0.201
French fries	McDonald's	NS	3	0.331	0.022	132	1 medium serving	0.436

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g			mmol/serving	
French fries	Burger King	NS	4	0.344	0.057	134	1 medium serving	0.461
French toast sticks	Burger King	NS	4	0.188	0.033	110	1 medium serving	0.207
Frosty dairy dessert	Wendy's	NS	1	0.164	-	221	1 medium	0.363
Grilled chicken sandwich	Wendy's	NS	1	0.152	-	181	1 sandwich	0.275
Ham, egg, and cheese bagel	McDonald's	NS	4	0.131	0.022	194	1 sandwich	0.254
Hamburger	McDonald's	NS	4	0.136	0.038	97	1 sandwich	0.132
Hamburger	Burger King	NS	4	0.184	0.016	115	1 sandwich	0.212
Hash brown rounds	Burger King	NS	4	0.245	0.032	77	1 serving	0.189
Hash browns	McDonald's	NS	4	0.351	0.041	50	1 medium serving	0.176
Hotcakes and sausage	McDonald's	NS	4	0.185	0.031	191	1 sandwich	0.353
Ice	Wendy's	NS	1	0.002	-	240		0.005
Ice	Burger King	NS	1	0.001	-	240		0.003
Iced tea, brewed, unsweetened	Wendy's	NS	1	0.372	-	237	8 oz (240 mL)	0.881
Junior hamburger	Wendy's	NS	4	0.139	0.023	115	1 sandwich	0.160
Junior hamburger with cheese	Wendy's	NS	1	0.099	-	136	1 sandwich	0.135
Nachos	Taco Bell	NS	4	0.356	0.020	77	1 serving	0.274
Nachos supreme	Taco Bell	NS	4	0.299	0.026	199	1 serving	0.595
Pepperoni pizza, regular crust	Pizza Hut	NS	5	0.179	0.011	96	1 slice of 12-in diameter pizza	0.172
Pepperoni pizza, thick crust	Pizza Hut	NS	3	0.144	0.018	96	1 slice of 12-in diameter pizza	0.139
Quarter pounder	McDonald's	NS	1	0.081	-	166	1 sandwich	0.134
Quarter pounder, no cheese	McDonald's	NS	1	0.094	-	157	1 sandwich	0.147
Sausage biscuit	McDonald's	NS	4	0.369	0.163	111	1 sandwich	0.410
Sausage biscuit with egg	McDonald's	NS	4	0.213	0.139	161	1 sandwich	0.342
Sausage breakfast burrito	McDonald's	NS	4	0.093	0.011	114	1 sandwich	0.106
Sausage McMuffin	McDonald's	NS	4	0.232	0.019	107	1 sandwich	0.248
Sausage McMuffin with egg	McDonald's	NS	4	0.160	0.017	156	1 sandwich	0.250
Soft taco with beef	Taco Bell	NS	4	0.100	0.004	101	1 taco	0.101
Soft taco with chicken	Taco Bell	NS	4	0.059	0.004	100	1 taco	0.059
Soft taco with steak	Taco Bell	NS	4	0.068	0.009	114	1 taco	0.078
Spanish omelet bagel	McDonald's	NS	3	0.147	0.015	220	1 sandwich	0.324
Steak, egg, and cheese bagel	McDonald's	NS	4	0.083	0.007	221	1 sandwich	0.184
Super supreme pizza, regular crust	Taco Bell	NS	4	0.198	0.027	127	1 slice of 12-in diameter pizza	0.251
Taco salad	Taco Bell	NS	4	0.132	0.010	465	1 salad	0.615
Thin crust pizza	Domino's	NS	4	0.284	0.050	39	1 slice of 14-in diameter pizza	0.111
Ultimate deep dish pizza, cheese	Domino's	NS	4	0.197	0.039	121	1 slice of 14-in diameter pizza	0.238
Ultimate deep dish pizza, pepperoni	Domino's	NS	4	0.186	0.030	127	1 slice of 14-in diameter pizza	0.237
Vanilla milkshake	McDonald's	NS	1	0.116	-	331	1 medium (16 oz)	0.383
Vanilla shake	Burger King	NS	1	0.075	-	320	1 medium (16 oz)	0.240
Whopper	Burger King	NS	4	0.058	0.013	266	1 sandwich	0.153
Whopper with cheese	Burger King	NS	1	0.055	-	292	1 sandwich	0.161
Cola, diet	Wendy's	NS	1	0.033	-	237	8 oz (240 mL)	0.078
Cola, diet	McDonald's	NS	1	0.022	-	237	8 oz (240 mL)	0.052
Cola, diet	Burger King	NS	1	0.054	-	237	8 oz (240 mL)	0.128
Cola, regular	Wendy's	NS	1	0.022	-	246	8 oz (240 mL)	0.055
Cola, regular	McDonald's	NS	1	0.004	-	246	8 oz (240 mL)	0.010
Cola, regular	Burger King	NS	1	0.027	-	246	8 oz (240 mL)	0.067
Deep dish pizza, cheese, large	Little Caesar's	NS	5	0.181	0.048	102	1 slice of 14-in diameter pizza	0.184
Deep dish pizza, pepperoni, large	Little Caesar's	NS	1	0.164	-	104	1 slice of 14-in diameter pizza	0.170

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g		g		mmol/serving
Lemon-lime soda, regular	Wendy's	NS	1	0.003	-	246	8 oz (240 mL)	0.007
Lemon-lime soda, regular	Burger King	NS	1	0.002	-	237	1 slice of 14-in diameter pizza	0.005
Original crust pizza, cheese	Papa John's	NS	4	0.297	0.047	117	1 slice of 14-in diameter pizza	0.347
Original crust pizza, pepperoni	Papa John's	NS	4	0.236	0.011	123	1 slice of 14-in diameter pizza	0.291
Original crust pizza, the works	Papa John's	NS	4	0.234	0.044	153	1 slice of 14-in diameter pizza	0.358
Original round pizza, cheese	Little Caesar's	NS	3	0.213	0.006	89	1 slice of 14-in diameter pizza	0.189
Original round pizza, pepperoni	Little Caesar's	NS	3	0.173	0.029	90	1 slice of 14-in diameter pizza	0.156
Original round pizza, with meat and vegetable toppings	Little Caesar's	NS	3	0.191	0.024	115	1 slice of 14-in diameter pizza	0.220
Thin crust pizza, cheese	Papa John's	NS	4	0.260	0.013	87	1 slice of 14-in diameter pizza	0.226
Thin crust pizza, cheese	Little Caesar's	NS	2	0.217	0.216–0.217	48	1 slice of 14-in diameter pizza	0.104
Fats and oils								0.000
Canola and corn oil blend	Mazola Right Blend	NS	1	0.187	-	14	1 tbsp	0.026
Canola and corn oil blend	Store brand	NS	1	0.292	-	14	1 tbsp	0.041
Canola oil	Crisco	NS	1	0.481	-	14	1 tbsp	0.067
Canola oil	Mazola Right Blend	NS	1	0.456	-	14	1 tbsp	0.064
Canola oil	Store brand	NS	1	0.385	-	14	1 tbsp	0.054
Canola oil	Wesson	NS	1	0.513	-	14	1 tbsp	0.072
Corn oil	Mazola	NS	1	0.340	-	14	1 tbsp	0.048
Corn oil	Store brand	NS	1	0.333	-	14	1 tbsp	0.047
Olive oil (mixture of types)	Store brand	NS	1	0.227	-	14	1 tbsp	0.032
Olive oil, extra virgin	Pompeian	NS	1	0.312	-	14	1 tbsp	0.044
Olive oil, extra virgin	Bertolli	NS	1	0.252	-	14	1 tbsp	0.035
Vegetable oil (soybean oil)	Store brand	NS	2	0.336	0.326–0.345	14	1 tbsp	0.047
Vegetable oil (soybean oil)	Crisco	NS	2	0.415	0.415–0.415	14	1 tbsp	0.058
Vegetable oil (soybean oil)	Mazola	NS	1	0.353	-	14	1 tbsp	0.049
Vegetable oil (soybean oil)	Store brand	NS	1	0.531	-	14	1 tbsp	0.074
Vegetable oil (soybean oil)	Wesson	NS	1	0.431	-	14	1 tbsp	0.060
Fish and seafood								0.000
Canned chunk light tuna in water	Chicken of the Sea	NS	1	0.093	-	85	3 oz	0.079
Crab, canned	Bumble Bee	NS	1	0.122	-	85	3 oz	0.104
Fish sticks, breaded, frozen, crunchy	Gortons	NS	1	0.056	-	112	four 4 × 1 × 1/2-in sticks	0.062
Fish sticks, breaded, frozen, crunchy	Mrs Paul's Select Cuts	NS	1	0.073	-	112	four 4 × 1 × 1/2-in sticks	0.082
Fish sticks, breaded, frozen, crunchy	Van De Kamps	NS	1	0.067	-	112	four 4 × 1 × 1/2-in sticks	0.075
Fish sticks, breaded, frozen, crunchy, baked	Gortons	NS	1	0.073	-	112	four 4 × 1 × 1/2-in sticks	0.081
Fish sticks, breaded, frozen, crunchy, baked	Mrs Paul's Select Cuts	NS	1	0.078	-	112	four 4 × 1 × 1/2-in sticks	0.087
Fish sticks, breaded, frozen, crunchy, baked	Van De Kamps	NS	1	0.079	-	112	four 4 × 1 × 1/2-in sticks	0.088

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g			mmol/serving	
Orange roughy, fillets		NS	3	0.025	0.003	85	3 oz	0.022
Orange roughy, fillets, baked		NS	2	0.043	0.037–0.048	85	3 oz	0.036
Pink salmon, canned, with skin and bones	Bumble Bee	NS	5	0.067	0.007	85	3 oz	0.057
Pink salmon, canned, with skin and bones	Chicken of the Sea	NS	4	0.071	0.005	85	3 oz	0.061
Pink salmon, canned, with skin and bones	Other brand	NS	5	0.081	0.012	85	3 oz	0.069
Pink salmon, canned, with skin and bones	Store brand	NS	5	0.066	0.015	85	3 oz	0.056
Red/sockeye salmon, canned, with skin and bones	Bumble Bee	NS	4	0.102	0.030	85	3 oz	0.086
Red/sockeye salmon, canned, with skin and bones	Chicken of the Sea	NS	2	0.080	0.076–0.084	85	3 oz	0.068
Red/sockeye salmon, canned, with skin and bones	Other brand	NS	5	0.064	0.013	85	3 oz	0.054
Red/sockeye salmon, canned, with skin and bones	Store brand	NS	4	0.127	0.033	85	3 oz	0.108
Shrimp, cooked, canned	Orleans or Bumble Bee	NS	1	0.041	-	85	3 oz	0.034
Tilapia, fillets		NS	3	0.083	0.046	85	3 oz	0.071
Tilapia, fillets, baked		NS	2	0.141	0.088–0.193	85	3 oz	0.119
Tuna, canned in water, chunk light	Star Kist	NS	3	0.094	0.016	85	3 oz	0.080
Tuna, canned in water, chunk light	Bumble Bee	NS	1	0.097	-	85	3 oz	0.082
Tuna, canned in water, chunk light	Store brand	NS	1	0.120	-	85	3 oz	0.102
Fruit and fruit juices								0.000
Apple juice, 100%, unsweetened, calcium-enriched, with added vitamin C	Minute Maid	NS	1	0.717	-	248	8 oz (240 mL)	1.779
Apple juice, 100%, unsweetened, with added vitamin C	Juicy Juice	NS	1	0.714	-	248	8 oz (240 mL)	1.771
Apple juice, 100%, unsweetened, with added vitamin C	Motts	NS	1	0.339	-	248	8 oz (240 mL)	0.840
Apple juice, 100%, unsweetened, with added vitamin C	Dole	NS	1	0.588	-	248	8 oz (240 mL)	1.457
Apples, composite of Red Delicious, Golden Delicious, Granny Smith, Gala, and Fuji		NS	4	0.311	0.085	138	1 medium fruit	0.429
Apples, Fuji		NS	4	0.224	0.097	138	1 medium fruit	0.309
Apples, Gala		NS	4	0.247	0.130	138	1 medium fruit	0.340
Apples, Golden Delicious		NS	8	0.261	0.094	138	1 medium fruit	0.361
Apples, Golden Delicious, without peel		NS	2	0.096	0.085–0.106	138	1 medium fruit	0.132
Apples, Granny Smith		NS	8	0.536	0.049	138	1 medium fruit	0.739
Apples, Red Delicious		NS	8	0.403	0.131	138	1 medium fruit	0.555
Apples, Red Delicious, without peel		NS	2	0.081	0.080–0.082	138	1 medium fruit	0.112
Bananas		NS	8	0.163	0.155	118	1 medium fruit	0.192

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g			mmol/serving	
Cherries (Bing or Sweet Red)		NS	4	0.354	0.067	145	1 cup, without pits	0.514
Cherries, sour, canned, heavy syrup, total can contents	Del Monte	NS	1	1.650	-	128	0.5 cup	2.112
Cherries, sour, canned, water pack, drained liquid	Kroger and Red Tart	NS	1	1.716	-	118		2.024
Cherries, sour, canned, water pack, drained liquid	Oregon and Kroger	NS	1	1.657	-	118		1.955
Cherries, sour, canned, water pack, drained solids	Kroger and Red Tart	NS	1	2.037	-	122	0.5 cup	2.485
Cherries, sour, canned, water pack, drained solids	Oregon and Kroger	NS	1	2.009	-	122	0.5 cup (used weight for 1 small tangerine)	2.451
Clementines		NS	4	0.744	0.161	70		0.521
Cranapple juice	Ocean Spray	NS	1	0.708	-	253	8 oz (240 mL)	1.790
Dates, Deglet Noor		NS	8	0.718	0.163	89	0.5 cup	0.639
Dates, Medjool		NS	1	0.565	-	89	0.5 cup	0.503
Figs		NS	8	0.779	0.087	74.5	0.5 cup	0.580
Grape juice, 100% (grape and grape blends), 100% grape juice	Welch's	NS	1	1.616	-	253	8 oz (240 mL)	4.089
Grape juice, 100% (grape and grape blends), sweetened	Minute Maid	NS	1	0.866	-	253	8 oz (240 mL)	2.190
Grape juice, 100% (grape and grape blends), unsweetened	Juicy Juice	NS	1	0.866	-	253	8 oz (240 mL)	2.192
Grape juice, 100% (grape and grape blends), unsweetened	Motts	NS	1	0.694	-	253	8 oz (240 mL)	1.757
Grapefruit, red		NS	8	0.595	0.088	123	0.5 fruit	0.731
Grapes, green		NS	4	0.133	0.020	160	1 cup	0.212
Grapes, red		NS	3	0.316	0.095	160	1 cup	0.505
Honeydew		NS	8	0.116	0.041	170	1 cup diced	0.197
Kiwi		NS	8	1.017	0.177	76	1 fruit	0.773
Kiwi, gold		L	1	1.632	-	76	1 fruit	1.240
Lime juice, fresh-squeezed		NS	4	0.468	0.047	67	1 fruit	0.313
Nectarines		NS	8	0.116	0.054	136	1 fruit	0.157
Orange juice concentrate, frozen	Store brand	NS	2	2.387	2.368–2.405	71	amount to make 8 oz (240 mL)	1.694
Orange juice concentrate, frozen, country style	Minute Maid	NS	1	2.362	-	71	amount to make 8 oz (240 mL)	1.677
Orange juice concentrate, frozen, original	Minute Maid	NS	2	2.512	2.442–2.581	71	amount to make 8 oz (240 mL)	1.783
Orange juice concentrate, frozen, pulp free	Minute Maid	NS	1	2.354	-	71	amount to make 8 oz (240 mL)	1.671
Orange juice, 100% (juice box), from concentrate	Minute Maid	NS	1	0.581	-	249	8 oz (240 mL)	1.446
Orange juice, 100% (juice box), from concentrate	Dean	NS	1	0.583	-	249	8 oz (240 mL)	1.451
Orange juice, 100% (juice box), from concentrate, with added vitamin C	Minute Maid	NS	1	0.759	-	249		1.889
Orange juice, refrigerated, Minute Maid Premium	Minute Maid Premium	NS	1	0.592	-	249	8 oz (240 mL)	1.475
Orange juice, refrigerated	Store brand	NS	3	0.566	0.083	249	8 oz (240 mL)	1.409

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g			mmol/serving	
Orange juice, refrigerated	Tropicana Pure Premium	NS	1	0.558	-	249	8 oz (240 mL)	1.389
Orange, navel		S	8	0.901	0.161	140	1 fruit	1.261
Peaches		NS	8	0.147	0.054	98	1 medium fruit	0.144
Peaches, canned in heavy syrup, drained liquid	Store brand	NS	1	0.105	-	118		0.124
Peaches, canned in heavy syrup, drained liquid	Del Monte	NS	1	0.104	-	118		0.123
Peaches, canned in heavy syrup, drained liquid	Libby	NS	1	0.103	-	118		0.122
Peaches, canned in heavy syrup, drained solids	Del Monte	NS	1	0.094	-	111	0.5 cup	0.104
Peaches, canned in heavy syrup, drained solids	Libby	NS	1	0.102	-	111	0.5 cup	0.113
Peaches, canned in heavy syrup, drained solids	Store brand	NS	1	0.104	-	111	0.5 cup	0.115
Pears, Bartlett		NS	8	0.215	0.030	166	1 medium fruit	0.358
Pears, Bosc		NS	8	0.177	0.026	166	1 medium fruit	0.294
Pears, composite of Bartlett, Green Anjou, and Bosc		NS	4	0.226	0.021	166	1 medium fruit	0.376
Pears, Green Anjou		NS	8	0.218	0.041	166	1 medium fruit	0.362
Pears, Red Anjou		NS	8	0.233	0.037	166	1 medium fruit	0.387
Pineapple		NS	5	0.600	0.364	155	1 cup diced	0.930
Pineapple juice, canned or bottled, unsweetened	Dole	NS	1	0.744	-	250	8 oz (240 mL)	1.859
Pineapple MDII	Del Monte Extra Gold	NS	8	1.046	0.197	155	1 cup diced	1.621
Plums		NS	7	0.834	0.289	66	1 fruit	0.551
Plums, black	Black Diamond	S	1	1.826	-	66	1 fruit	1.205
Prunes		NS	8	2.018	0.403	85	0.5 cup	1.715
Raisins		NS	8	0.780	0.092	82	0.5 cup	0.639
Tangerines		NS	3	0.616	0.047	84	1 fruit	0.518
Tangerines, honey		L	1	0.445	-	84	1 fruit	0.374
Watermelon		NS	7	0.042	0.011	152	1 cup diced	0.064
Grains and grain products								
Bagels, plain	Store bakery	NS	1	0.108	-	105	1 medium bagel	0.113
Bagels, plain	Pepperidge Farm	NS	1	0.096	-	105	1 medium bagel	0.100
Bagels, plain, frozen	Lenders Original Recipe	NS	1	0.110	-	105	1 medium bagel	0.116
Bagels, plain, frozen	Lenders Original Recipe	NS	1	0.235	-	83	1 medium bagel	0.195
Bagels, plain, frozen	Sara Lee	NS	1	0.154	-	105	1 medium bagel	0.161
Bagels, plain, frozen, toasted	Sara Lee	NS	1	0.287	-	83	1 medium bagel	0.238
Bagels, plain, New York style	Thomas	NS	1	0.124	-	105	1 medium bagel	0.131
Bagels, plain, New York style, toasted	Thomas	NS	1	0.306	-	83	1 medium bagel	0.254
Bagels, plain, toasted	Store bakery	NS	1	0.396	-	83	1 medium bagel	0.329
Bagels, plain, toasted	Pepperidge Farm	NS	1	0.227	-	83	1 medium bagel	0.188
Biscuits, refrigerated, buttermilk fluffy, cooked	Pillsbury Hungry Jack	NS	1	0.274	-	54	2 biscuits	0.148
Biscuits, refrigerated, cooked, Grands Butter Tustin' Biscuits	Pillsbury	NS	1	0.262	-	54	2 biscuits	0.141
Biscuits, refrigerated, Grands Butter Tustin' Biscuits	Pillsbury	NS	1	0.084	-	60	2 biscuits	0.050

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g			mmol/serving	
Biscuits, refrigerated, Big Country Butter Tastin' Fluffy, cooked	Pillsbury	NS	1	0.280	-	54	2 biscuits	0.151
Biscuits, refrigerated, Big Country Buttermilk	Pillsbury	NS	1	0.009	-	60	2 biscuits	0.005
Biscuits, refrigerated, Golden Layers Butter Tastin' Biscuits	Pillsbury Hungry Jack	NS	1	0.030	-	60	2 biscuits	0.018
Biscuits, refrigerated, Golden Layers Butter Tastin', cooked	Pillsbury Hungry Jack	NS	1	0.195	-	54	2 biscuits	0.105
Biscuits, refrigerated, Golden Layers Buttermilk	Pillsbury Hungry Jack	NS	1	0.077	-	60	2 biscuits	0.046
Biscuits, refrigerated, Golden Layers Buttermilk, cooked	Pillsbury Hungry Jack	NS	1	0.332	-	54	2 biscuits	0.179
Biscuits, refrigerated, Grands Buttermilk Biscuits	Pillsbury	NS	1	0.017	-	60	2 biscuits	0.010
Biscuits, refrigerated, Grands Buttermilk, cooked	Pillsbury	NS	1	0.158	-	54	2 biscuits	0.085
Bread crumbs, plain	Progresso	NS	2	0.324	0.301-0.347	27	0.25 cup	0.087
Bread crumbs, plain	Colonna	NS	1	0.323	-	27	0.25 cup	0.087
Bread crumbs, plain, store brand	Store brand	NS	4	0.311	0.030	27	0.25 cup	0.084
Bread crumbs, seasoned	Store brand	NS	2	0.405	0.368-0.442	30	0.25 cup	0.122
Bread crumbs, seasoned, garlic and herb	Progresso	NS	1	0.470	-	30	0.25 cup	0.141
Bread crumbs, seasoned, Italian style	Progresso	NS	2	0.417	0.389-0.444	30	0.25 cup	0.125
Bread crumbs, seasoned, parmesan cheese	Progresso	NS	1	0.374	-	30	0.25 cup	0.112
Corn grits, white, instant	Quaker	NS	4	0.179	0.015	52	0.33 cup	0.093
Corn grits, white, instant	Store brand	NS	3	0.119	0.015	52	0.33 cup	0.062
Corn grits, white, instant, microwave cooked	Quaker	NS	4	0.033	0.022	242	1 cup	0.080
Corn grits, white, instant, microwave cooked	Store brand	NS	3	0.025	0.009	242	1 cup	0.061
Corn grits, white, instant, prepared with boiling water	Quaker	NS	3	0.051	0.021	242	1 cup	0.124
Corn grits, white, instant, prepared with boiling water	Store brand	NS	3	0.027	0.019	242	1 cup	0.065
Corn grits, white, quick	Quaker	NS	4	0.225	0.027	52	0.33 cup	0.117
Corn grits, white, quick	Store brand	NS	2	0.141	0.072-0.210	52	0.33 cup	0.073
Corn grits, white, quick, boiled	Store brand	NS	2	0.036	0.015-0.057	242	1 cup	0.087
Corn grits, white, quick, cooked on stovetop	Quaker	NS	4	0.063	0.006	242	1 cup	0.152
Corn grits, white, quick, microwave cooked	Quaker	NS	3	0.052	0.006	242	1 cup	0.126
Corn grits, white, quick, microwave cooked	Store brand	NS	2	0.038	0.018-0.057	242	1 cup	0.091
Corn grits, yellow, cooked on stovetop	Quaker	NS	1	0.284	-	52	0.33 cup	0.148
Corn grits, yellow, quick	Store brand	NS	1	0.193	-	52	0.33 cup	0.100
Corn grits, yellow, quick, cooked on stovetop	Quaker	NS	1	0.083	-	242	1 cup	0.200

(Continued)



TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g			mmol/serving	
Corn grits, yellow, quick, cooked on stovetop	Store brand	NS	1	0.078	-	242	1 cup	0.188
Corn grits, yellow, quick, microwave cooked	Quaker	NS	1	0.083	-	242	1 cup	0.202
Corn grits, yellow, quick, microwave cooked	Store brand	NS	1	0.061	-	242	1 cup	0.148
Corn meal, degermed	Name brand	NS	1	0.405	-	46	0.33 cup	0.186
Corn meal, degermed	Store brand	NS	1	0.271	-	46	0.33 cup	0.125
Corn tortillas, refrigerated	Guerrero	NS	1	0.399	-	48	2 tortillas	0.191
Corn tortillas, refrigerated	Don Pacho	NS	1	0.376	-	48	2 tortillas	0.181
Corn tortillas, refrigerated	El Torro	NS	1	0.476	-	48	2 tortillas	0.229
Corn, whole-kernel, canned, drained liquid	Lakeside Foods	NS	2	0.169	0.144–0.193	118	0.5 cup	0.199
Corn, whole-kernel, canned, drained solids	Lakeside Foods	NS	2	0.186	0.150–0.221	82	0.5 cup	0.152
Cream of wheat, cooked on stovetop, 2.5 min	Nabisco	NS	4	0.025	0.003	241	1 cup	0.060
Cream of wheat, cooked on stovetop, 2.5 min	Store brand	NS	3	0.028	0.015	241	1 cup	0.067
Cream of wheat, cooked on stovetop, 1 min	Nabisco	NS	3	0.016	0.002	241	1 cup	0.039
Cream of wheat, cooked on stovetop, 1 min	Store brand	NS	2	0.018	0.016–0.020	241	1 cup	0.043
Cream of wheat, instant, microwave cooked	Nabisco	NS	4	0.021	0.008	241	1 cup	0.049
Cream of wheat, instant, microwave cooked	Store brand	NS	1	0.017	-	241	1 cup	0.042
Cream of wheat, instant, prepared with boiling water	Nabisco	NS	4	0.015	0.005	241	1 cup	0.036
Cream of wheat, instant, prepared with boiling water	Store brand	NS	1	0.040	-	241	1 cup	0.096
Cream of wheat, microwave cooked, 2.5 min	Nabisco	NS	4	0.026	0.003	241	1 cup	0.063
Cream of wheat, microwave cooked, 2.5 min	Store brand	NS	3	0.027	0.007	241	1 cup	0.064
Dinner rolls, soft dinner rolls, country style	Pepperidge Farm	NS	1	0.052	-	46	2 rolls	0.024
Dinner rolls, soft dinner rolls, Parker House	Pepperidge Farm	NS	1	0.072	-	64	2 rolls	0.046
Dinner rolls, soft dinner rolls, Parker House, cooked	Pepperidge Farm	NS	1	0.164	-	56	2 rolls	0.092
Dinner rolls, brown and serve rolls	Any brand	NS	1	0.070	-	56	2 rolls	0.039
Dinner rolls, brown and serve rolls, cooked	Any brand	NS	1	0.087	-	56	2 rolls	0.049
Dinner rolls, soft dinner rolls, country style, cooked	Pepperidge Farm	NS	1	0.223	-	56	2 rolls	0.125
Egg noodles, wide	Light 'N Fluffy	NS	1	0.069	-	57	2 oz	0.039
Egg noodles, wide	Muellers	NS	1	0.074	-	57	2 oz	0.042
Egg noodles, wide, cooked		NS	1	0.034	-	160	1 cup	0.054
Egg noodles, wide, cooked	Muellers	NS	1	0.023	-	160	1 cup	0.036

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g		g		mmol/serving
Egg noodles, wide, cooked	Store brand	NS	1	0.038	-	160	1 cup	0.061
Elbow macaroni, cooked	Store brand	NS	1	0.033	-	140	1 cup	0.046
Elbow macaroni, cooked	Creamette	NS	1	0.031	-	140	1 cup	0.044
English muffins, cinnamon raisin	Thomas	NS	1	0.198	-	57	1 muffin	0.113
English muffins, cinnamon raisin	Store brand	NS	1	0.211	-	52	1 muffin	0.110
English muffins, cinnamon raisin, toasted	Thomas	NS	1	0.363	-	57	1 muffin	0.207
English muffins, cinnamon raisin, toasted	Store brand	NS	1	0.356	-	52	1 muffin	0.185
English muffins, plain	Thomas	NS	1	0.043	-	57	1 muffin	0.025
English muffins, plain	Store brand	NS	1	0.052	-	57	1 muffin	0.030
English muffins, plain, toasted	Thomas	NS	1	0.107	-	52	1 muffin	0.056
Flour tortillas, refrigerated	Foods of New Mexico	NS	1	0.070	-	46	1 large 7–8-in diameter	0.032
Flour tortillas, refrigerated	La Favorita	NS	1	0.064	-	46	1 large 7–8-in diameter	0.029
Flour tortillas, refrigerated	Mex American	NS	1	0.058	-	46	1 large 7–8-in diameter (used weight equivalent to other bread)	0.027
French bread	Any brand	NS	2	0.174	0.163–0.185	50		0.087
French bread, toasted	Store brand	NS	2	0.308	0.286–0.330	46	2 slices	0.142
Hamburger/hot dog rolls, hamburger rolls	Store brand	NS	2	0.182	0.174–0.189	43	1 roll	0.078
Hamburger/hot dog rolls, hot dog rolls	Store brand	NS	3	0.171	0.013	43	1 roll	0.074
Instant white rice	Minute	NS	1	0.073	-	31.7	0.33 cup	0.023
Instant white rice, cooked	Minute	NS	2	0.026	0.026–0.026	165	1 cup	0.043
Instant white rice, cooked	Store brand	NS	1	0.017	-	165	1 cup	0.028
Oatmeal, instant	Quaker	NS	1	0.463	-	27	0.33 cup	0.125
Oatmeal, instant	Store brand	NS	1	0.451	-	27	0.33 cup	0.122
Oatmeal, instant, boiled	Quaker	NS	1	0.114	-	234	1 cup	0.266
Oatmeal, instant, boiled	Store brand	NS	1	0.101	-	234	1 cup	0.236
Oatmeal, instant, microwave cooked	Quaker	NS	1	0.082	-	234	1 cup	0.193
Oatmeal, instant, microwave cooked	Store brand	NS	1	0.088	-	234	1 cup	0.206
Oatmeal, old-fashioned	Quaker	NS	1	0.371	-	27	0.33 cup	0.100
Oatmeal, old-fashioned	Store brand	NS	1	0.340	-	27	0.33 cup	0.092
Oatmeal, old-fashioned, boiled	Quaker	NS	1	0.110	-	234	1 cup	0.257
Oatmeal, old-fashioned, boiled	Store brand	NS	1	0.096	-	234	1 cup	0.224
Oatmeal, old-fashioned, microwave cooked	Store brand	NS	1	0.085	-	234	1 cup	0.200
Oatmeal, old-fashioned, microwave cooked	Quaker	NS	1	0.093	-	234	1 cup	0.218
Oatmeal, quick-cooking	Store brand	NS	1	0.362	-	27	0.33 cup	0.098
Oatmeal, quick-cooking, 1-min oats, boiled	Quaker	NS	1	0.101	-	234	1 cup	0.236
Oatmeal, quick-cooking, 1-min oats	Quaker	NS	1	0.446	-	27	0.33 cup	0.120

(Continued)



TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g			mmol/serving	
Oatmeal, quick-cooking, 1-min oats, microwave cooked	Quaker	NS	1	0.083	-	234	1 cup	0.193
Oatmeal, quick-cooking, boiled	Store brand	NS	1	0.086	-	234	1 cup	0.200
Oatmeal, quick-cooking, microwave cooked	Store brand	NS	1	0.085	-	234	1 cup	0.199
Spaghetti, regular	Store brand	NS	1	0.120	-	57	2 oz	0.068
Spaghetti, regular	Muellers	NS	1	0.116	-	57	2 oz	0.066
Spaghetti, regular	Store brand	NS	1	0.110	-	57	2 oz	0.063
Spaghetti, regular	Ronzoni	NS	1	0.038	-	57	2 oz	0.022
Spaghetti, regular, cooked	Muellers	NS	1	0.022	-	140	1 cup	0.031
Spaghetti, regular, cooked	Ronzoni	NS	1	0.024	-	140	1 cup	0.033
Spaghetti, regular, cooked	San Giorgio	NS	1	0.016	-	140	1 cup	0.022
Spaghetti, regular, cooked	Muellers	NS	1	0.049	-	140	1 cup	0.068
Spaghetti, regular, cooked	Store brand	NS	1	0.060	-	140	1 cup	0.084
Spaghetti, regular, cooked	Ronzoni	NS	1	0.024	-	140	1 cup	0.034
Spaghetti, regular, cooked	San Giorgio	NS	1	0.022	-	140	1 cup	0.031
Taco shells, corn, hard, ready-to-eat	Ortega	NS	1	0.583	-	26.6	2 medium (≈5-in diameter)	0.155
Taco shells, corn, hard, ready-to-eat	Old El Paso	NS	1	0.374	-	26.6	2 medium (≈5-in diameter)	0.099
Taco shells, corn, hard, ready-to-eat	Store brand	NS	1	0.531	-	26.6	2 medium (≈5-in diameter)	0.141
Wheat bread	Wonder	NS	1	0.312	-	50	2 slices	0.156
Wheat bread	Store brand	NS	1	0.338	-	50	2 slices	0.169
Wheat bread	Other brand	NS	1	0.323	-	50	2 slices	0.161
Wheat bread, toasted	Wonder	NS	1	0.541	-	46	2 slices	0.249
Wheat bread, toasted	Store brand	NS	1	0.520	-	46	2 slices	0.239
Wheat bread, toasted	Other brand	NS	1	0.598	-	46	2 slices	0.275
White bread, sliced	Store brand	NS	5	0.156	0.009	50	2 slices	0.078
White bread, sliced	Wonder	NS	1	0.153	-	50	2 slices	0.077
White rice, extra-long-grain, cooked	Canilla	NS	1	0.031	-	175	1 cup	0.054
White rice, extra-long-grain, cooked (tap water)	Canilla	NS	1	0.031	-	175	1 cup	0.054
White rice, long-grain	Store brand	NS	4	0.081	0.033	61.7	0.33 cup	0.050
White rice, long-grain	Canilla	NS	2	0.097	0.096–0.098	61.7	0.33 cup	0.060
White rice, long-grain, cooked	Store brand	NS	5	0.032	0.007	175	1 cup	0.056
White rice, long-grain, cooked	Canilla	NS	2	0.039	0.038–0.039	175	1 cup	0.067
White rice, long-grain, cooked (tap water)	Store brand	NS	1	0.032	-	175	1 cup	0.055
White rice, long-grain, cooked, canilla (tap water)	Canilla	NS	1	0.033	-	175	1 cup	0.058
White rice, long-grain, parboiled	Uncle Ben's	NS	1	0.169	-	175	1 cup	0.296
White rice, long-grain, parboiled, cooked	Uncle Ben's	NS	3	0.119	0.012	61.7	0.33 cup	0.073
Whole-wheat bread	Nature's Own	NS	1	0.506	-	56	2 slices	0.283
Whole-wheat bread	Oroweat	NS	1	0.465	-	56	2 slices	0.260
Whole-wheat bread	Wonder	NS	1	0.465	-	56	2 slices	0.261

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g		g		mmol/serving
Whole-wheat bread, toasted	Nature's Own	NS	1	0.929	-	50	2 slices	0.464
Whole-wheat bread, toasted	Wonder	NS	1	0.997	-	50	2 slices	0.499
Infant foods and beverages								
Beef	Beechnut stage 1	NS	1	0.076	-	71	1 jar (2.5 oz)	0.054
Beef	Gerber 2nd foods	NS	1	0.050	-	71	1 jar (2.5 oz)	0.036
Beef	Heinz	NS	1	0.062	-	71	1 jar (2.5 oz)	0.044
Broccoli and chicken dinner	Gerber 2nd foods	NS	1	0.385	-	113	1 jar (4 oz)	0.435
Broccoli and chicken dinner	Gerber Graduates	NS	1	0.127	-	113	1 jar (4 oz)	0.144
Broccoli and chicken dinner	Heinz	NS	1	0.446	-	113	1 jar (4 oz)	0.503
Broccoli and chicken dinner, heated	Heinz	NS	1	0.467	-	113	1 jar (4 oz)	0.528
Chicken	Beechnut stage 1	NS	1	0.104	-	71	1 jar (2.5 oz)	0.074
Chicken	Gerber 2nd foods	NS	1	0.056	-	71	1 jar (2.5 oz)	0.040
Chicken	Heinz	NS	1	0.017	-	71	1 jar (2.5 oz)	0.012
Green beans	Gerber 1st foods	NS	1	0.084	-	71	1 jar (2.5 oz)	0.059
Green beans	Heinz	NS	1	0.053	-	71	1 jar (2.5 oz)	0.038
Lamb	Beechnut stage 1	NS	1	0.052	-	71	1 jar (2.5 oz)	0.037
Lamb	Gerber 2nd foods	NS	1	0.047	-	71	1 jar (2.5 oz)	0.033
Oatmeal cereal, unprepared	Gerber	NS	1	0.563	-	2.5	1 tbsp	0.014
Peaches	Beechnut stage 1	NS	1	1.167	-	71	1 jar (2.5 oz)	0.829
Peaches	Gerber 1st foods	NS	1	1.061	-	71	1 jar (2.5 oz)	0.754
Peaches	Heinz	NS	1	1.248	-	71	1 jar (2.5 oz)	0.886
Peas	Beechnut stage 1	NS	1	0.104	-	71	1 jar (2.5 oz)	0.074
Peas	Gerber 1st foods	NS	1	0.095	-	71	1 jar (2.5 oz)	0.068
Peas	Heinz	NS	1	0.089	-	71	1 jar (2.5 oz)	0.063
Squash	Gerber 1st foods	NS	1	0.110	-	71	1 jar (2.5 oz)	0.078
Squash	Heinz	NS	1	0.167	-	71	1 jar (2.5 oz)	0.118
Turkey	Beechnut stage 1	NS	1	0.056	-	71	1 jar (2.5 oz)	0.040
Turkey	Gerber 2nd foods	NS	1	0.050	-	71	1 jar (2.5 oz)	0.035
Turkey	Heinz	NS	1	0.038	-	71	1 jar (2.5 oz)	0.027
Turkey, sticks and diced	Beechnut Table Time	NS	1	0.052	-	71	1 jar (2.5 oz)	0.037
Turkey, sticks and diced	Gerber Graduates	NS	1	0.061	-	71	1 jar (2.5 oz)	0.043
Veal	Beechnut stage 1	NS	1	0.073	-	71	1 jar (2.5 oz)	0.052
Veal	Gerber 2nd foods	NS	1	0.054	-	71	1 jar (2.5 oz)	0.038
Vegetable and beef dinner	Beechnut stage 2	NS	1	0.064	-	113	1 jar (4 oz)	0.073
Vegetable and beef dinner	Gerber 2nd foods	NS	1	0.116	-	113	1 jar (4 oz)	0.131
Vegetable and beef dinner	Heinz	NS	1	0.091	-	113	1 jar (4 oz)	0.103
Legumes								
Edamame, frozen		NS	2	0.471	0.417–0.524	72	0.5 cup; includes pod	0.339
Edamame, frozen, prepared		NS	2	0.431	0.347–0.515	78	0.5 cup; includes pod	0.336
Kidney beans, canned, light red	Store brand	NS	1	0.268	-	256	1 cup	0.686
Kidney beans, canned, light red, heated	Store brand	NS	1	0.264	-	256	1 cup	0.677
Navy beans, dry		NS	1	0.569	-	104	0.5 cup	0.591
Navy beans, dry, cooked		NS	1	0.108	-	182	1 cup	0.197
Peas, baby, canned, drained liquid	Store brand	NS	1	0.100	-	84		0.084
Peas, baby, canned, drained liquid	Le Sueur	NS	1	0.113	-	84		0.095
Peas, baby, canned, drained solids	Store brand	NS	1	0.008	-	85	0.5 cup	0.007

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g			mmol/serving	
Peas, regular, canned, drained liquid	Del Monte	NS	1	0.153	-	103.5	0.5 cup	0.158
Peas, regular, canned, drained liquid	Green Giant	NS	1	0.167	-	103.5	0.5 cup	0.173
Peas, regular, canned, drained liquid	Store brand	NS	1	0.062	-	103.5	0.5 cup	0.064
Peas, regular, canned, drained solids	Del Monte	NS	1	0.117	-	85	0.5 cup	0.099
Peas, regular, canned, drained solids	Green Giant	NS	1	0.115	-	85	0.5 cup	0.098
Peas, regular, canned, drained solids	Store brand	NS	1	0.088	-	85	0.5 cup	0.075
Peas, regular, canned, drained solids, heated	Del Monte	NS	1	0.112	-	85	0.5 cup	0.096
Peas, regular, canned, drained solids, heated	Green Giant	NS	1	0.120	-	85	0.5 cup	0.102
Peas, regular, canned, drained solids, heated	Store brand	NS	1	0.113	-	85	0.5 cup	0.096
Pinto beans, dried		NS	4	1.184	0.391	96	0.5 cup	1.137
Pinto beans, dried, cooked		NS	4	0.192	0.008	171	1 cup	0.328
Meat, meat products, and substitutes								
Beef hot dogs	Oscar Mayer	NS	1	0.469	-	45	1 frankfurter, 10 per pound	0.211
Beef hot dogs	Ball Park	NS	1	0.369	-	45	1 frankfurter, 10 per pound	0.166
Beef hot dogs	Store brand	NS	1	0.392	-	45	1 frankfurter, 10 per pound	0.176
Beef hot dogs	Farmer John	NS	1	0.509	-	45	1 frankfurter, 10 per pound	0.229
Beef hot dogs	Nathan's	NS	1	0.377	-	45	1 frankfurter, 10 per pound	0.170
Beef hot dogs	Kahn's	NS	1	0.429	-	45	1 frankfurter, 10 per pound	0.193
Beef hot dogs, cooked (boiled)	Oscar Mayer	NS	1	0.472	-	45	1 frankfurter, 10 per pound	0.213
Beef hot dogs, cooked (boiled)	Ball Park	NS	1	0.338	-	45	1 frankfurter, 10 per pound	0.152
Meat franks	Hygrade	NS	1	0.159	-	45	1 frankfurter, 10 per pound	0.071
Meat franks	Bryan	NS	2	0.321	0.314–0.327	45	1 frankfurter, 10 per pound	0.144
Meat franks	Oscar Mayer	NS	1	0.296	-	45	1 frankfurter, 10 per pound	0.133
Meat franks, cooked (boiled)	Hygrade	NS	1	0.237	-	45	1 frankfurter, 10 per pound	0.107
Meat franks, cooked (boiled)	Oscar Mayer	NS	1	0.350	-	45	1 frankfurter, 10 per pound	0.158
Meat franks, jumbo	Bar S, Jumbo	NS	2	0.250	0.241–0.259	45	1 frankfurter, 10 per pound	0.113
Veggie burgers	Boca Burger's Chef Max's all American classic	NS	1	0.108	-	85	1 patty	0.092
Veggie burgers	Morningstar Farms Grillers, Hamburger Style	NS	1	0.199	-	85	1 patty	0.170
Veggie burgers	Morningstar Farms Garden Veggie	NS	1	0.302	-	85	1 patty	0.257

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g		g		mmol/serving
Veggie burgers	Gardenburger Original	NS	1	0.165	-	85	1 patty	0.140
Miscellaneous ingredients								
Artificial sweetener	Equal	NS	1	0.022	-		1/8 tsp, equivalent to 1 tsp sugar	0.000
Artificial sweetener, calorie-free sweetener	Sugar Twin	NS	1	0.007	-		1/8 tsp, equivalent to 1 tsp sugar	0.000
Artificial sweetener, calorie-free sweetener	Splenda	NS	1	0.003	-		1/8 tsp, equivalent to 1	0.000
Aspartame	Monsanto	S	2	0.039	0.023–0.054			0.000
Barley malt syrup, organic	Sweet Cloud	L	1	2.121	-	20		0.424
Brown rice syrup, powdered, organic	Emperor's Kitchen	L	1	1.041	-	28.35		0.295
Brown rice malt syrup, organic	Sweet Cloud	L	1	0.717	-	20		0.143
Corn syrup, light	Karo	NS	1	0.008	-	20	30 mL (1 tbsp = 20 g)	0.002
Corn syrup, light	Clements Foods Co	S	3	0.005	0.002	20	30 mL (1 tbsp = 20 g)	0.001
Honey	Any brand	NS	1	0.135	-	21	1 tbsp	0.028
Honey	Dutch Gold	NS	1	0.138	-	21	1 tbsp	0.029
Honey	Golden Blossom	NS	1	0.193	-	21	1 tbsp	0.041
Honey	Store brand	NS	1	0.159	-	21	1 tbsp	0.033
Honey	Sue Bee	NS	1	0.139	-	21	1 tbsp	0.029
Honey, clover	FMV	L	1	0.161	-	21		0.034
Maple syrup, 100% pure	Spring Tree	L	1	0.454	-	20		0.091
Molasses, dark	Brer Rabbit	L	1	4.900	-	20		0.980
Salt, iodized	Morton	NS	1	0.000	-	6	1 tsp	0.000
Stevia powder, plus fiber	Sweet Leaf	L	1	0.038	-	0.5		0.000
Sugar, raw cane, organic	Sweet Cloud	L	1	0.327	-	28.35		0.093
Sugar, refined, granulated	Kroger	L	1	0.004	-	28.35		0.001
Sugar, turbinado	Ruger in the Raw	L	1	0.210	-	28.35	1 oz	0.059
Vinegar, apple cider	Heinz	NS	1	0.108	-	17	1 tbsp	0.018
Vinegar, apple cider	Store brand	NS	1	0.122	-	17	1 tbsp	0.021
Vinegar, apple cider	Other brand	NS	1	0.115	-	17	1 tbsp	0.020
Vinegar, balsamic		NS	1	0.243	-	17	1 tbsp	0.041
Vinegar, balsamic		NS	1	0.737	-	17	1 tbsp	0.125
Vinegar, balsamic		NS	1	0.884	-	17	1 tbsp	0.150
Vinegar, distilled white	Heinz	NS	1	0.004	-	17	1 tbsp	0.001
Vinegar, distilled white	Store brand	NS	1	0.005	-	17	1 tbsp	0.001
Vinegar, distilled white	Other brand	NS	1	0.000	-	17	1 tbsp	0.000
Vinegar, red wine	Regina	NS	1	0.408	-	17	1 tbsp	0.069
Vinegar, red wine	Store brand	NS	1	0.227	-	17	1 tbsp	0.039
Vinegar, red wine	Other brand	NS	1	0.280	-	17	1 tbsp	0.048
Mixed food entrees (casseroles, stews, sandwiches, etc)								
Baked beans, pork and beans in brown sugar sauce	Bush's	NS	1	0.240	-	253	1 cup	0.608
Baked beans, pork and beans in brown sugar sauce	Heinz	NS	1	0.293	-	253	1 cup	0.742
Baked beans, pork and beans in brown sugar sauce	Campbell's	NS	1	0.218	-	253	1 cup	0.550
Baked beans, pork and beans in brown sugar sauce	B&M	NS	1	0.385	-	253	1 cup	0.975

(Continued)



TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g		g		mmol/serving
Baked beans, pork and beans in brown sugar sauce	Store brand	NS	1	0.287	-	253	1 cup	0.727
Baked beans, pork and beans in brown sugar sauce, heated	Bush's	NS	1	0.206	-	253	1 cup	0.521
Baked beans, pork and beans in brown sugar sauce, heated	B&M	NS	1	0.375	-	253	1 cup	0.949
Baked beans, pork and beans in brown sugar sauce, heated	Store brand	NS	1	0.275	-	253	1 cup	0.696
Baked beans, pork and beans in tomato sauce	Bush's	NS	1	0.191	-	253	1 cup	0.484
Baked beans, pork and beans in tomato sauce	Heinz	NS	1	0.183	-	253	1 cup	0.462
Baked beans, pork and beans in tomato sauce	Campbell's	NS	1	0.207	-	253	1 cup	0.522
Baked beans, pork and beans in tomato sauce	B&M	NS	1	0.158	-	253	1 cup	0.401
Baked beans, pork and beans in tomato sauce	Store brand	NS	1	0.141	-	253	1 cup	0.358
Baked beans, pork and beans in tomato sauce, heated	Campbell's	NS	1	0.212	-	253	1 cup	0.536
Baked beans, pork and beans in tomato sauce, heated	Store brand	NS	1	0.170	-	253	1 cup	0.430
Baked beans, vegetarian	Bush's	NS	1	0.253	-	253	1 cup	0.639
Baked beans, vegetarian	Heinz	NS	1	0.261	-	253	1 cup	0.659
Baked beans, vegetarian	Campbell's	NS	1	0.216	-	253	1 cup	0.547
Baked beans, vegetarian	B&M	NS	1	0.291	-	253	1 cup	0.736
Baked beans, vegetarian	Store brand	NS	1	0.235	-	253	1 cup	0.594
Baked beans, vegetarian, heated	Bush's	NS	1	0.268	-	253	1 cup	0.678
Baked beans, vegetarian, heated	Heinz	NS	1	0.243	-	253	1 cup	0.614
Bean and cheese burritos, frozen	Tina's	NS	2	0.108	0.085-0.130	143	1 burrito	0.154
Bean and cheese burritos, frozen	Marquez	NS	2	0.127	0.126-0.128	117	1 burrito	0.149
Bean and cheese burritos, frozen	Old El Paso	NS	1	0.079	-	144	1 burrito	0.114
Bean and cheese burritos, frozen	Las Campanas	NS	1	0.127	-	121	1 burrito	0.154
Bean and cheese burritos, frozen, cooked	Tina's	NS	1	0.133	-	118	1 burrito	0.157
Bean and cheese burritos, frozen, cooked	Old El Paso	NS	1	0.087	-	121	1 burrito	0.105
Beef and bean burritos, frozen	Tina's	NS	2	0.095	0.084-0.105	144	1 burrito	0.136
Beef and bean burritos, frozen	Patio	NS	1	0.072	-	144	1 burrito	0.104
Beef and bean burritos, frozen	Marquez	NS	1	0.118	-	122	1 burrito	0.144
Beef and bean burritos, frozen	El Monterey	NS	1	0.173	-	103	1 burrito	0.178
Beef and bean burritos, frozen, cooked	Tina's	NS	1	0.111	-	122	1 burrito	0.136
Beef and bean burritos, frozen, cooked	Patio	NS	1	0.107	-	119	1 burrito	0.128

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				<i>mmol/100 g</i>			<i>mmol/serving</i>	
Beef and bean burritos, frozen, family pack	Tina's	NS	1	0.168	-	106	1 burrito	0.178
Beef stew, canned	Dinty Moore	NS	8	0.125	0.021	232	1 cup	0.290
Beef stew, canned	Castleberry	NS	1	0.180	-	232	1 cup	0.418
Beef stew, canned	Armour	NS	1	0.074	-	232	1 cup	0.172
Beef stew, canned	Store brand	NS	1	0.137	-	232	1 cup	0.318
Beef stew, canned	Austex	NS	1	0.137	-	232	1 cup	0.317
Beef stew, canned, cooked	Dinty Moore	NS	1	0.127	-	232	1 cup	0.294
Canned macaroni and cheese	Franco American	NS	1	0.040	-	252	1 serving	0.101
Canned macaroni and cheese	Chef Boyardee	NS	1	0.043	-	252	1 serving	0.109
Canned macaroni and cheese (microwaveable cans)	Hormel Kid's Kitchen	NS	1	0.243	0.118–0.125	252	1 serving	0.612
Cheese lasagna, frozen, five-cheese	Stouffer's	NS	1	0.731	-	305	1 serving (1 package)	2.230
Cheese lasagna, frozen, five-cheese, cooked	Stouffer's	NS	1	0.530	-	291	1 serving (1 package)	1.543
Cheese lasagna, frozen, mozzarella	Budget Gourmet	NS	1	0.139	-	238	1 serving (1 package)	0.331
Cheese lasagna, frozen, three-cheese	Budget Gourmet	NS	1	0.163	-	245	1 serving (1 package)	0.398
Cheese lasagna, frozen, three-cheese	Budget Gourmet	NS	1	0.305	-	245	1 serving (1 package)	0.748
Cheese lasagna, frozen, three-cheese, cooked	Budget Gourmet	NS	1	0.176	-	228	1 serving (1 package)	0.401
Cheese pizza, frozen, regular thin crust	McCain Ellio's	NS	1	0.108	-	79	1 serving (per package label)	0.085
Cheese pizza, frozen, regular thin crust	Totino's	NS	1	0.103	-	147	1 serving (per package label)	0.151
Cheese pizza, frozen, regular thin crust	Tony's	NS	2	0.127	0.114–0.139	170	1 serving (per package label)	0.215
Cheese pizza, frozen, regular thin crust	Celeste Pizza for One	NS	1	0.152	-	181	1 serving (per package label)	0.275
Cheese pizza, frozen, regular thin crust	Mr P's	NS	1	0.162	-	180	1 serving (per package label)	0.291
Cheese pizza, frozen, rising crust	DiGiorno	NS	1	0.212	-	139	1 serving (per package label)	0.295
Cheese pizza, frozen, rising crust	Red Baron	NS	1	0.192	-	129	1 serving (per package label)	0.248
Cheese pizza, frozen, rising crust	Tony's	NS	1	0.083	-	141	1 serving (per package label)	0.118
Cheese pizza, frozen, rising crust	Tombstone	NS	1	0.160	-	154	1 serving (per package label)	0.247
Chicken pot pie, frozen, cooked	Banquet	NS	1	0.050	-	198	1 serving	0.100
Chili with meat and beans, canned	Hormel	NS	2	0.519	0.499–0.539	246	1 cup	1.277
Chili with neat and beans, canned	Nalley	NS	2	0.322	0.321–0.322	246	1 cup	0.791
Chili with meat and beans, canned	Dennisons	NS	1	0.420	-	246	1 cup	1.034
Chili with meat and beans, canned	Chili Man	NS	1	0.411	-	246	1 cup	1.011
Chili with neat and beans, canned	Wolf	NS	1	0.401	-	246	1 cup	0.987
Chili with neat and beans, canned	Bryan	NS	1	0.420	-	246	1 cup	1.034
Chili with meat and beans, canned	Armour	NS	2	0.401	0.397–0.405	246	1 cup	0.986

(Continued)



TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	<i>n</i>	Antioxidant content	SD or range	Servings size ⁵	Serving description ⁵	Antioxidant content
				<i>mmol/100 g</i>		<i>g</i>		<i>mmol/serving</i>
Chili with meat and beans, canned (hot)	Store brand	NS	1	0.395	-	246	1 cup	0.971
Chili with meat and beans, canned (thick)	Nalley	NS	1	0.479	-	246	1 cup	1.177
Chili with meat and beans, canned, heated	Hormel	NS	1	0.497	-	246	1 cup	1.223
Chili with meat, no beans, canned	Hormel	NS	6	0.393	0.026	246	1 cup	0.966
Chili with meat, no beans, canned	Wolf	NS	3	0.486	0.013	246	1 cup	1.196
Chili with meat, no beans, canned	Armour	NS	1	0.449	-	246	1 cup	1.105
Chili with meat, no beans, canned	Store brand	NS	1	0.352	-	246	1 cup	0.867
Chili with meat, no beans, canned	Bunker Hill	NS	1	0.457	-	246	1 cup	1.123
Chili with meat, no beans, canned, heated	Hormel	NS	1	0.400	-	246	1 cup	0.985
Lasagna with meat, frozen, lower fat	Lean Cuisine	NS	2	0.371	0.309–0.432	313	1 serving (1 package)	1.160
Lasagna with meat, frozen, lower fat	Weight Watchers Smart Ones	NS	1	0.132	-	258	1 serving (1 package)	0.342
Lasagna with meat, frozen, regular	Stouffer's	NS	2	0.479	0.460–0.498	215	1 serving	1.030
Lasagna with meat, frozen, regular	Michelina's	NS	2	0.163	0.126–0.199	215	1 serving	0.349
Lasagna with meat, frozen, regular, cooked	Stouffer's	NS	1	0.183	-	215	1 serving	0.394
Lasagna with meat, frozen, regular, cooked	Michelina's	NS	1	0.119	-	215	1 serving	0.255
Macaroni and cheese mix (with dry cheese powder)	Kraft	NS	3	0.061	0.028	70	1 NLEA serving (to make ≈ 1 cup)	0.043
Macaroni and cheese mix (with dry cheese powder)	Store brand	NS	3	0.064	0.036	70	1 NLEA serving (to make ≈ 1 cup)	0.045
Macaroni and cheese mix (with dry cheese powder), prepared	Kraft	NS	1	0.042	-	183	1 cup	0.077
Macaroni and cheese mix (with dry cheese powder), prepared	Store brand	NS	1	0.045	-	186	1 cup	0.084
Macaroni and cheese mix (with prepared cheese sauce), prepared	Kraft Velveeta	NS	1	0.026	-	186	1 cup	0.048
Macaroni and cheese mix (with prepared cheese sauce), prepared	Kraft Deluxe	NS	1	0.029	-	157	1 cup	0.046
Sausage and pepperoni pizza, frozen, cooked	Tony's	NS	1	0.158	-	169	1 serving (per package label)	0.266
Sausage and pepperoni pizza, frozen, cooked	Red Baron	NS	1	0.181	-	133	1 serving (per package label)	0.241
Spaghetti with meat, canned	Chef Boyardee	NS	3	0.218	0.026	255	1 cup	0.555
Spaghetti with meat, canned	Franco American Spaghettios with Meatballs	NS	3	0.170	0.014	255	1 cup	0.433
Spaghetti with meat, canned, heated	Chef Boyardee	NS	1	0.220	-	249	1 cup	0.547

(Continued)



TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g		g		mmol/serving
Spaghetti with meat, canned, heated	Franco American Spaghettios with Meatballs	NS	1	0.155	-	249	1 cup	0.386
Spaghetti, no meat, canned	Franco American Spaghettios	NS	2	0.141	0.139–0.142	251	1 cup	0.353
Spaghetti, no meat, canned	Franco American Where's Waldo	NS	1	0.137	-	251	1 cup	0.345
Spaghetti, no meat, canned	Franco American Garfield Spaghettios	NS	1	0.133	-	251	1 cup	0.333
Spaghetti, no meat, canned	Franco American	NS	2	0.122	0.121–0.123	251	1 cup	0.306
Spaghetti, no meat, canned, heated	Franco American Spaghettios	NS	1	0.133	-	245	1 cup	0.325
Turkey pot pie, frozen, cooked	Swanson	NS	1	0.057	-	198	1 serving	0.113
Nuts and seeds								
Almonds		NS	4	0.535	0.036	28.35		0.152
Brazil nuts		NS	7	0.319	0.220	28.35	1 oz	0.090
Cashews		NS	6	0.642	-	28.35		0.182
Flaxseed, ground or milled		NS	1	1.125	-	28.35	1 oz	0.319
Flaxseed, whole brown		NS	1	0.804	-	28.35	1 oz	0.228
Hazelnuts		NS	8	0.936	0.561	28.35	1 oz	0.265
Macadamia nuts		NS	1	0.587	-	28.35		0.166
Peanut butter, creamy	Skippy	NS	2	0.658	0.622–0.694	32	2 tbsp	0.211
Peanut butter, creamy	Jif	NS	1	0.570	-	32	2 tbsp	0.182
Peanut butter, crunchy	Store brand	NS	2	0.506	0.470–0.542	32	2 tbsp	0.162
Peanut butter, crunchy	Skippy	NS	1	0.550	-	32	2 tbsp	0.176
Peanuts		NS	4	0.351	0.146	28.35	1 oz	0.099
Pecans		NS	7	9.668	2.669	28.35	1 oz	2.741
Pine nuts		NS	8	0.715	0.078	28.35	1 oz	0.203
Pistachios		NS	8	1.426	0.125	28.35	1 oz	0.404
Poppy seeds		NS	1	0.029	-	2.8	1 tsp	0.001
Sesame seeds, hulled		NS	1	0.061	-	28.35	1 oz	0.017
Walnuts		NS	6	13.126	4.881	28.35	1 oz	3.721
Poultry and poultry products								
BBQ chicken wings, frozen	Tyson	NS	1	0.388	-	86	1 serving, per package label	0.334
BBQ chicken wings, frozen	TGIF	NS	1	0.072	-	86	1 serving, per package label	0.062
BBQ chicken wings, frozen	Simmons	NS	1	0.207	-	86	1 serving, per package label	0.178
BBQ chicken wings, frozen, cooked in conventional oven	Tyson	NS	3	0.384	0.040	96	1 serving, per package label	0.369
BBQ chicken wings, frozen, cooked in conventional oven	Mixed brands	NS	4	0.334	0.050	96	1 serving, per package label	0.320
BBQ chicken wings, frozen, cooked in conventional oven	Remarkable	NS	1	0.116	-	96	1 serving, per package label	0.111
BBQ chicken wings, frozen, cooked in conventional oven	TGIF	NS	1	0.076	-	96	1 serving, per package label	0.073
BBQ chicken wings, frozen, cooked in conventional oven	Simmons	NS	1	0.228	-	96	1 serving, per package label	0.218
BBQ chicken wings, frozen, microwave cooked	Tyson	NS	1	0.337	-	74	1 serving, per package label	0.249

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g			mmol/serving	
BBQ chicken wings, frozen, microwave cooked	TGIF	NS	1	0.076	-	74	1 serving, per package label	0.056
BBQ chicken wings, frozen, microwave cooked	Simmons	NS	1	0.283	-	74	1 serving, per package label	0.210
Chicken hot dogs	Gwaltney	NS	2	0.145	0.143–0.147	45	1 frankfurter, 10 per pound	0.065
Chicken hot dogs	Grillmaster	NS	1	0.157	-	45	1 frankfurter, 10 per pound	0.071
Chicken hot dogs	Weaver	NS	1	0.146	-	45	1 frankfurter, 10 per pound	0.066
Chicken hot dogs	Talmadge Farms	NS	1	0.179	-	45	1 frankfurter, 10 per pound	0.080
Chicken hot dogs	Shorgood	NS	1	0.199	-	45	1 frankfurter, 10 per pound	0.089
Chicken hot dogs, cooked	Gwaltney	NS	1	0.174	-	45	1 frankfurter, 10 per pound	0.078
Chicken nuggets, frozen	Store brand	NS	1	0.087	-	85	3-oz serving	0.074
Chicken nuggets, frozen	Weaver	NS	1	0.121	-	85	3-oz serving	0.103
Chicken nuggets, frozen, cooked	Store brand	NS	1	0.144	-	81	3-oz serving, cooked	0.116
Chicken nuggets, frozen, cooked	Advance Fast Fixin'	NS	1	0.117	-	81	3-oz serving, cooked	0.095
Chicken nuggets, frozen, cooked	Weaver	NS	1	0.157	-	81	3-oz serving, cooked	0.127
Chicken patties, frozen	Tyson	NS	1	0.117	-	85	3-oz serving	0.100
Chicken patties, frozen	Tyson	NS	1	0.152	-	81	3-oz serving, cooked	0.123
Chicken patties, frozen	Kings Delight	NS	1	0.132	-	81	3-oz serving, cooked	0.107
Chicken patties, frozen, cooked	Tyson	NS	1	0.148	-	81	3-oz serving, cooked	0.120
Chicken tenders, frozen	Mixed brands	NS	1	0.133	-	86	1 serving, per package label	0.114
Chicken tenders, frozen	Tyson	NS	1	0.092	-	86	1 serving, per package label	0.079
Chicken tenders, frozen, cooked in conventional oven	Tyson	NS	3	0.117	0.019	76	1 serving, per package label	0.089
Chicken tenders, frozen, cooked in conventional oven	Banquet	NS	2	0.121	0.116–0.125	76	1 serving, per package label	0.092
Chicken tenders, frozen, cooked in conventional oven	Store brand	NS	1	0.163	-	76	1 serving, per package label	0.124
Chicken tenders, frozen, cooked in conventional oven	Weaver	NS	1	0.114	-	76	1 serving, per package label	0.086
Chicken tenders, frozen, cooked in conventional oven	Butterball	NS	1	0.115	-	76	1 serving, per package label	0.088
Chicken tenders, frozen, microwave cooked	Mixed brands	NS	1	0.140	-	75	1 serving, per package label	0.105
Chicken tenders, frozen, southern, cooked in conventional oven	Banquet	NS	1	0.145	-	76	1 serving, per package label	0.110
Snacks								
Cheese crackers with cheese filling	Lance	NS	1	0.819	-	42	6 crackers	0.344
Cheese crackers with cheese filling	Frito Lay	NS	2	0.726	0.792–0.659	42	6 crackers	0.305

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g		g		mmol/serving
Cheese crackers with cheese filling	Austin	NS	2	0.772	0.757–0.787	42	6 crackers	0.324
Cheese crackers with cheese filling	Store brand	NS	1	0.763	-	42	6 crackers	0.320
Cheese crackers with peanut butter filling	Little Debbie	NS	2	0.950	0.923–0.976	42	6 crackers	0.399
Cheese crackers with peanut butter filling	Lance	NS	2	0.857	0.777–0.936	42	6 crackers	0.360
Cheese crackers with peanut butter filling	Austin	NS	2	0.900	0.837–0.962	42	6 crackers	0.378
Cheese puff-type cheese snacks	Cheetos	NS	1	0.800	-	28.35		0.227
Cheese puff-type cheese snacks	Cheetos	NS	8	0.476	0.113	28.35	1 oz	0.135
Cheese puff-type cheese snacks, crunchy	Cheetos	NS	1	0.631	-	28.35		0.179
Kernel popcorn, air-popped	Store brand	NS	2	0.816	0.799–0.833	24	3 cups	0.196
Kernel popcorn, air-popped	Jolly Time	NS	1	0.858	-	24	3 cups	0.206
Kernel popcorn, air-popped	Orville	NS	1	0.834	-	24	3 cups	0.200
Kernel popcorn, air-popped	Redenbacher							
Kernel popcorn, air-popped	Store brand	NS	4	0.742	0.059	33	3 cups	0.245
Kernel popcorn, oil-popped	Jolly Time	NS	1	0.748	-	33	3 cups	0.247
Kernel popcorn, oil-popped	Orville	NS	1	0.724	-	33	3 cups	0.239
Kernel popcorn, oil-popped	Redenbacher							
Multigrain snack chips	Sun Chips	NS	5	0.748	0.086	28.35	1 oz	0.212
Popcorn, microwave, 94% fat-free, butter flavor	Pop Secret	NS	1	0.458	-	33	3 cups	0.151
Popcorn, microwave, 94% fat-free, butter flavor	Orville	NS	1	0.587	-	33	3 cups	0.194
Popcorn, microwave, 94% fat-free, butter flavor	Redenbacher							
Popcorn, microwave, 94% fat-free, butter flavor	Smart Pop							
Popcorn, microwave, 94% fat-free, butter flavor	Jolly Time	NS	1	0.624	-	33	3 cups	0.206
Popcorn, microwave, 94% fat-free, butter flavor	Healthy Pop							
Popcorn, microwave, 94% fat-free, butter flavor	Store brand	NS	1	0.594	-	33	3 cups	0.196
Popcorn, microwave, butter flavor	Pop Secret	NS	1	0.482	-	33	3 cups	0.159
Popcorn, microwave, butter flavor	Orville	NS	1	0.372	-	33	3 cups	0.123
Popcorn, microwave, butter flavor	Redenbacher							
Popcorn, microwave, butter flavor	Jolly Time	NS	1	0.519	-	33	3 cups	0.171
Popcorn, microwave, butter flavor	Butterlicious							
Popcorn, microwave, butter flavor	Store brand	NS	1	0.471	-	33	3 cups	0.155
Potato chips	Lays Classic	NS	1	0.778	-	28.35	1 oz	0.220
Potato chips	Ruffles	NS	2	0.586	0.475–0.696	28.35	1 oz	0.166
Potato chips	Lays	NS	2	0.737	0.649–0.824	28.35	1 oz	0.209
Potato chips	Store brand	NS	1	0.471	-	28.35	1 oz	0.133
Potato chips, fat-free, made with olein (olestra), original flavor	Pringles	NS	1	0.444	-	28.35	1 oz	0.126
Potato chips, made with olestra, original flavor	Lays Wow	NS	1	0.148	-	28.35	1 oz	0.042
Pretzels	Frito Lay Rold Gold	NS	1	1.104	-	28.35	1 oz	0.313
Pretzels	Snyders of Hanover/Utz	NS	1	0.981	-	28.35	1 oz	0.278
Pretzels	Store brand	NS	1	0.766	-	28.35	1 oz	0.217

(Continued)



TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g			mmol/serving	
Saltine crackers	Store brand	NS	2	0.281	0.273–0.289	18	6 square crackers	0.051
Saltine crackers	Nabisco Premium Original	NS	2	0.371	0.368–0.374	18	6 square crackers	0.067
Saltine crackers	Sunshine Krispy Original	NS	1	0.435	-	18	6 square crackers	0.078
Saltine crackers	Sunshine Keebler Zesty Original	NS	1	0.278	-	18	6 square crackers	0.050
Toasty peanut butter filled crackers	Ritz Bitz	NS	2	1.067	0.943–1.190	42	6 crackers	0.448
Toasty peanut butter filled crackers	Little Debbie	NS	1	1.170	-	39	6 crackers	0.456
Toasty peanut butter filled crackers	Keebler	NS	1	1.065	-	39	6 crackers	0.415
Toasty peanut butter filled crackers	Austin	NS	1	0.973	-	39	6 crackers	0.380
Toasty peanut butter filled crackers	Golden Flake	NS	1	0.970	-	39	6 crackers	0.378
Tortilla chips	Mission	NS	1	0.768	-	28.35	1 oz	0.218
Tortilla chips, 100% white corn	Tostitos	NS	5	0.767	0.135	28.35	1 oz	0.217
Tortilla chips, cooler ranch flavor	Doritos	NS	1	0.744	-	28.35		0.211
Tortilla chips, made with olestra, nacho cheesier flavor	Doritos Wow	NS	1	0.224	-	28.35	1 oz	0.063
Tortilla chips, made with olestra, restaurant style	Tostitos Wow	NS	1	0.162	-	28.35	1 oz	0.046
Tortilla chips, nacho cheesier flavor	Doritos	NS	1	0.717	-	28.35		0.203
Soups, sauces, gravies, dressings, etc								
Bottled salsa, mild	Tostitos	NS	2	0.329	0.319–0.339	30	2 tbsp	0.099
Bottled salsa, roasted garlic flavor	Tostitos	NS	1	0.314	-	30	2 tbsp	0.094
Bottled salsa, Thick & Chunky, mild	Pace	NS	1	0.362	-	30	2 tbsp	0.109
Bottled salsa, Thick n' Chunky, medium	Old El Paso	NS	1	0.303	-	30	2 tbsp	0.091
Bottled salsa, Thick n' Chunky, mild	Old El Paso	NS	1	0.307	-	30	2 tbsp	0.092
Chicken broth, canned, 99% fat-free	Swanson	NS	1	0.000	-	251	1 cup	0.000
Chicken Noodle Cup a Soup, dry	Knorr	NS	1	0.445	-	14.8	amount to make 1 cup prepared	0.066
Condensed chicken noodle soup	Campbell's	NS	5	0.026	0.005	123	amount to make 1 cup prepared	0.032
Condensed chicken noodle soup	Store brand	NS	1	0.012	-	123	amount to make 1 cup prepared	0.014
Condensed cream of chicken soup	Campbell's	NS	5	0.041	0.009	125.5	amount to make 1 cup prepared	0.052
Condensed cream of chicken soup	Store brand	NS	1	0.029	-	125.5	amount to make 1 cup prepared	0.036
Condensed cream of mushroom soup	Campbell's	NS	1	0.042	-	125.5	amount to make 1 cup prepared	0.053
Condensed tomato soup	Campbell's	NS	5	0.240	0.015	125.5	amount to make 1 cup prepared	0.301
Condensed tomato soup	Store brand	NS	1	0.658	-	125.5	amount to make 1 cup prepared	0.826
French salad dressing	Western	NS	1	0.439	-	16	1 tbsp	0.070
French salad dressing	Kraft	NS	3	0.465	0.038	16	1 tbsp	0.074
French salad dressing	Store brand	NS	1	0.440	-	16	1 tbsp	0.070

(Continued)



TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g		g		mmol/serving
French salad dressing	Henri's	NS	1	0.420	-	16	1 tbsp	0.067
French salad dressing, fat-free	Kraft Free	NS	3	0.037	0.007	16	1 tbsp	0.006
French salad dressing, lite	Western	NS	1	0.425	-	16	1 tbsp	0.068
Gravy, beef, canned	Heinz Homestyle	NS	1	0.061	-	58.25	0.25 cup	0.036
Gravy, turkey, canned	Franco American	NS	1	0.059	-	60	0.25 cup	0.035
Gravy, turkey, canned	Heinz Homestyle	NS	1	0.047	-	60	0.25 cup	0.028
Gravy, turkey, canned	Store brand	NS	1	0.044	-	60	0.25 cup	0.027
Italian salad dressing	Wishbone	NS	4	0.315	0.031	14.7	1 tbsp	0.046
Italian salad dressing	Store brand	NS	2	0.408	0.357-0.459	14.7	1 tbsp	0.060
Italian salad dressing, fat-free	Kraft Free	NS	2	0.082	0.073-0.090	14	1 tbsp	0.011
Italian salad dressing, fat-free	Seven Seas	NS	1	0.084	-	14	1 tbsp	0.012
Italian salad dressing, lite	Wishbone	NS	2	0.141	0.129-0.153	14	1 tbsp	0.020
Mustard, yellow, prepared	French's Classic	NS	1	1.566	-	2.5	0.5 tsp	0.039
Mustard, yellow, prepared	Store brand	NS	1	1.520	-	2.5	0.5 tsp	0.038
Mustard, yellow, prepared	Other brand	NS	1	1.417	-	2.5	0.5 tsp	0.035
Pasta sauce, no meat, chunky garden combination	Ragu	NS	1	0.371	-	125	0.5 cup	0.463
Pasta sauce, no meat, mushroom flavor	Prego	NS	2	0.505	0.500-0.510	125	0.5 cup	0.631
Pasta sauce, no meat, mushroom flavor	Hunt's	NS	1	0.515	-	125	0.5 cup	0.644
Pasta sauce, no meat, old world style	Ragu	NS	1	0.397	-	125	0.5 cup	0.497
Pasta sauce, no meat, three-cheese flavor	Prego	NS	1	0.375	-	125	0.5 cup	0.469
Ramen noodle soup, beef flavor, dry	Nissin Top Ramen Noodles	NS	1	0.409	-	43	1 serving	0.176
Ranch salad dressing	Hidden Valley	NS	1	0.367	-	14	1 tbsp	0.051
Ranch salad dressing	Kraft	NS	1	0.458	-	14	1 tbsp	0.064
Ranch salad dressing	Wishbone	NS	1	0.408	-	14	1 tbsp	0.057
Ranch salad dressing, fat-free	Kraft Free	NS	1	0.017	-	14	1 tbsp	0.002
Ranch salad dressing, fat-free	Hidden Valley	NS	1	0.217	-	14	1 tbsp	0.030
Ranch salad dressing, fat-free	Wishbone	NS	1	0.033	-	14	1 tbsp	0.005
Ranch salad dressing, lite	Hidden Valley	NS	2	0.191	0.184-0.197	14	1 tbsp	0.027
Ranch salad dressing, lite	Kraft Light Done Right	NS	1	0.144	-	14	1 tbsp	0.020
Ranch salad dressing, lite	Wishbone	NS	1	0.185	-	14	1 tbsp	0.026
Soup, chicken noodle, canned, ready-to-eat	Campbell's Kitchen Classics	NS	1	0.019	-	240	1 cup	0.045
Soup, chicken noodle, canned, ready-to-eat	Progresso Traditional	NS	1	0.017	-	240	1 cup	0.042
Thousand Island salad dressing, fat-free	Kraft Free	NS	3	0.070	0.003	16	1 tbsp	0.011
Thousand Island salad dressing, lite	Kraft Light Done Right	NS	2	0.316	0.303-0.328	15	1 tbsp	0.047
Tomato ketchup	Heinz	NS	3	0.406	0.018	15	1 tbsp	0.061
Tomato ketchup	Store brand	NS	3	0.370	0.004	15	1 tbsp	0.055
Tomato paste, canned	Hunt's	NS	2	0.980	0.978-0.982	60.5	0.25 cup	0.593
Tomato paste, canned	Store brand	NS	2	0.883	0.865-0.901	60.5	0.25 cup	0.534
Tomato paste, canned	Contadina	NS	2	1.028	0.919-1.136	60.5	0.25 cup	0.622
Tomato purée, canned	TuttoToro	NS	1	0.429	-	62.6	0.25 cup	0.269
Tomato purée, canned	Progresso	NS	1	0.489	-	62.6	0.25 cup	0.306

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g			mmol/serving	
Tomato purée, canned	Contadina	NS	2	0.400	0.385–0.414	62.6	0.25 cup	0.250
Tomato purée, canned	Redpack	NS	1	0.422	-	62.6	0.25 cup	0.264
Tomato purée, canned	Pope	NS	1	0.415	-	62.6	0.25 cup	0.260
Tomato sauce, canned	Store brand	NS	4	0.292	0.021	61.25	0.25 cup	0.179
Tomato sauce, canned	Hunt's	NS	2	0.341	0.304–0.378	61.25	0.25 cup	0.209
Spices and herbs								
Basil leaf, dried		NS	1	12.307	-	0.7	1 tsp	0.086
Basil leaf, fresh		NS	1	0.822	-	0.7	1 tsp	0.006
Chili powder		NS	1	8.372	-	2.6	1 tsp	0.218
Cinnamon, ground		NS	1	17.647	-	2.3	1 tsp	0.406
Cloves, ground		NS	1	125.549	-	2.1	1 tsp	2.637
Curry powder		NS	1	9.980	-	2	1 tsp	0.200
Garlic powder		NS	1	0.803	-	2.8	1 tsp	0.022
Ginger, ground		NS	1	21.571	-	1.8	1 tsp	0.388
Mustard seed, yellow, ground		NS	1	10.527	-	3.3	1 tsp	0.347
Onion powder		NS	1	0.948	-	2.4	1 tsp	0.023
Oregano leaf, dried		NS	1	40.299	-	1	1 tsp	0.403
Paprika		NS	1	8.601	-	2.1	1 tsp	0.181
Parsley, dried		NS	1	7.430	-	0.3	1 tsp	0.022
Pepper, black, ground		NS	1	4.543	-	2.1	1 tsp	0.095
Pepper, black, whole peppercorns		NS	1	4.344	-	2.1	1 tsp ground	0.091
Tumeric		NS	1	15.679	-	2.2	1 tsp	0.345
Chocolate and sweets								
Candy bar	Snickers	NS	1	0.729	-	57	1 bar (2 oz)	0.415
Candy bar	Tootsie Rolls	NS	1	1.401	-	52.8	8 pieces	0.740
Candy bar	Kit Kat	NS	1	0.717	-	46	1 bar (1.625 oz)	0.330
Chocolate, baking, unsweetened	Bakers	NS	2	7.278	7.013–7.542	28.35	1 oz	2.063
Chocolate, baking, unsweetened	Hershey's	NS	1	10.474	-	28.35	1 oz	2.969
Chocolates, dark, sugar-free	Hershey's	NS	1	4.188	-	40	5 pieces	1.675
Chocolates, peanut butter cups miniatures, sugar-free	Reese's	NS	1	1.077	-	40	5 pieces	0.431
Chocolates, sugar-free	Hershey's	NS	1	2.567	-	39	5 pieces	1.001
Coconut, sweetened, flaked	Bakers Angel Flake	NS	1	0.095	-	12	2 tbsp	0.011
Coconut, sweetened, flaked	Other brand	NS	1	0.092	-	12	2 tbsp	0.011
Coconut, sweetened, flaked	Store brand	NS	1	0.093	-	12	2 tbsp	0.011
Granola bars, 100% natural crunchy oats and honey	Nature Valley	NS	1	0.826	-	22	1 bar	0.182
Granola bars, chewy, chocolate chip	Quaker	NS	1	0.365	-	32	1 bar	0.117
Granola bars, chewy, chocolate chip	Sunbelt	NS	1	0.755	-	37	1 bar	0.279
Granola bars, chewy, chocolate chip	Store brand	NS	1	0.604	-	30	1 bar	0.181
Granola bars, chewy, oats and honey	Sunbelt	NS	1	0.395	-	34	1 bar	0.134
Granola bars, store brand, crunchy	Store brand	NS	1	0.776	-	21	1 bar	0.163
Milk chocolate candy	Hershey's Kisses	NS	4	1.498	0.072	28.35	1 oz	0.425
Milk chocolate candy	Brachs Stars	NS	1	1.250	-	28.35	1 oz	0.354
Milk chocolate candy bar	Hershey's	NS	3	1.547	0.227	28.35	1 oz	0.438
Milk chocolate candy bar	Cadbury	NS	1	1.955	-	28.35	1 oz	0.554

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g		g		mmol/serving
Milk chocolate peanut butter cups, 10 pack	Reese's	NS	1	0.959	-	36	2 pieces	0.345
Milk chocolate peanut butter cups, miniatures	Reese's	NS	1	1.069	-	38	5 pieces	0.406
Power bar, chocolate flavor	Power Bar	NS	1	2.757	-	68	1 bar	1.875
Vegetables and vegetable products								
Artichoke hearts, brine pack	Delallo	L	1	3.357	-	84		2.820
Artichoke hearts, water pack	Progresso	L	1	4.325	-	84		3.633
Artichokes, boiled	Ocean Mist	S	1	4.537	-	84	1 cup hearts	3.811
Artichokes, boiled	Other brand	L	1	3.891	-	84		3.268
Artichokes, microwaved	Ocean Mist	S	1	4.694	-	84	1 cup hearts	3.943
Asparagus		NS	4	0.363	0.069	67	0.5 cup	0.243
Asparagus, cooked		NS	4	0.753	0.087	90	0.5 cup	0.678
Avocados		NS	8	0.413	0.059	173	1 fruit	0.714
Baby carrots		NS	8	0.038	0.005	80	8 medium	0.030
Broccoli		NS	8	0.248	0.111	44	0.5 cup chopped	0.109
Broccoli raab		NS	2	0.651	0.559-0.742	85	1 NLEA serving	0.553
Broccoli raab, cooked		NS	4	0.969	0.157	85	1 NLEA serving	0.823
Broccoli, cooked		NS	4	1.000	0.101	78	0.5 cup chopped	0.780
Cabbage		NS	4	0.100	0.031	35	0.5 cup	0.035
Cabbage, cooked		NS	4	0.448	0.064	75	0.5 cup	0.336
Cabbage, red		NS	4	0.798	0.055	35	0.5 cup	0.279
Cabbage, red, cooked		NS	4	2.153	0.288	75	0.5 cup	1.614
Canned whole tomatoes in tomato juice	Store brand	NS	3	0.241	0.011	120	0.5 cup	0.290
Canned whole tomatoes in tomato juice	Hunt's	NS	2	0.263	0.254-0.272	120	0.5 cup	0.316
Canned whole tomatoes in tomato juice	Red Gold	NS	1	0.232	-	120	0.5 cup	0.279
Cantaloupe		NS	8	0.250	0.047	160	1 cup cubed	0.399
Carrots		NS	4	0.034	0.014	61	0.5 cup sliced	0.021
Carrots, cooked		NS	4	0.099	0.037	78	0.5 cup sliced	0.077
Carrots, cut, frozen	Store brand	NS	5	0.056	0.007	64	0.5 cup	0.036
Carrots, cut, frozen	Birds Eye	NS	1	0.051	-	64	0.5 cup	0.032
Carrots, cut, frozen, boiled	Store brand	NS	2	0.074	0.069-0.079	78	0.5 cup	0.058
Carrots, cut, frozen, microwaved	Store brand	NS	3	0.080	0.007	78	0.5 cup	0.062
Carrots, frozen	Store brand	NS	5	0.072	0.016	64	0.5 cup	0.046
Carrots, frozen	Birds Eye	NS	1	0.069	-	64	0.5 cup	0.044
Carrots, frozen, boiled	Store brand	NS	2	0.069	0.060-0.077	78	0.5 cup	0.053
Carrots, frozen, boiled	Birds Eye	NS	1	0.081	-	78	0.5 cup	0.063
Carrots, frozen, microwaved	Store brand	NS	2	0.081	0.069-0.092	78	0.5 cup	0.063
Carrots, frozen, microwaved	Birds Eye	NS	1	0.095	-	78	0.5 cup	0.074
Celery		NS	8	0.062	0.013	60	0.5 cup diced	0.037
Cucumber, with peel		NS	4	0.037	0.008	52	0.5 cup slices	0.019
Cucumber, without peel		NS	4	0.018	0.006	59.5	0.5 cup slices	0.011
French fried potatoes, frozen, crinkle cut	Ore Ida	NS	1	0.259	-	65	10 strips	0.168
French fried potatoes, frozen, cooked, steak fries	Ore Ida	NS	1	0.267	-	50	10 strips	0.134
French fried potatoes, frozen, crinkle cut	Store brand or other brand	NS	1	0.266	-	65	10 strips	0.173

(Continued)

TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g		g		mmol/serving
French fried potatoes, frozen, crinkle cut, cooked	Store brand or other brand	NS	1	0.247	-	50	10 strips	0.123
French fried potatoes, frozen, crinkle cut, cooked	Ore Ida	NS	1	0.219	-	50	10 strips	0.110
French fried potatoes, frozen, shoestring	Ore Ida	NS	1	0.384	-	65	10 strips	0.250
French fried potatoes, frozen, shoestring	Store brand or other brand	NS	1	0.261	-	65	10 strips	0.170
French fried potatoes, frozen, shoestring, cooked	Ore Ida	NS	1	0.340	-	50	10 strips	0.170
French fried potatoes, frozen, shoestring, cooked	Store brand or other brand	NS	1	0.307	-	50	10 strips	0.153
French fried potatoes, frozen, steak fries	Ore Ida	NS	1	0.264	-	65	10 strips	0.172
French fried potatoes, frozen, steak fries	Store brand or other brand	NS	1	0.232	-	65	10 strips	0.150
French fried potatoes, frozen, steak fries, cooked	Store brand or other brand	NS	1	0.208	-	50	10 strips	0.104
French fried potatoes, frozen, tater tots	Store brand or other brand	NS	1	0.277	-	65		0.180
French fried potatoes, frozen, tater tots, seasoned shredded potatoes, cooked	Ore Ida	NS	1	0.127	-	50		0.063
French fried potatoes, frozen, tater tots, seasoned shredded potatoes	Ore Ida	NS	1	0.096	-	65		0.062
French fried potatoes, frozen, tater tots, cooked	Store brand or other brand	NS	1	0.224	-	50		0.112
Lettuce, romaine		NS	8	0.208	0.048	47	1 cup shredded	0.098
Lettuce, butterhead		NS	7	0.138	0.091	55	1 cup shredded	0.076
Lettuce, green leaf		NS	8	0.244	0.043	36	1 cup shredded	0.088
Lettuce, iceberg		NS	8	0.175	0.414	72	1 cup shredded	0.126
Lettuce, red leaf		NS	8	0.229	0.066	28	1 cup shredded	0.064
Mushrooms, crimini		NS	2	0.250	0.216–0.283	43	0.5 cup, whole	0.107
Mushrooms, enoki		NS	2	0.255	0.233–0.277	21	0.5 cup, whole	0.054
Mushrooms, enoki	Monterrey Mushrooms	S	1	0.333	-	21	0.5 cup, whole	0.070
Mushrooms, enoki	Phillips Mushrooms	S	1	0.313	-	21	0.5 cup, whole	0.066
Mushrooms, maitake	Monterrey Mushrooms	S	1	0.226	-	35	0.5 cup, diced	0.079
Mushrooms, maitake	Phillips Mushrooms	S	1	0.109	-	35	0.5 cup, diced	0.038
Mushrooms, oyster		NS	3	0.061	0.035	41	0.5 cup, whole	0.025
Mushrooms, portabella		NS	2	0.225	0.201–0.248	43	0.5 cup, diced	0.097
Mushrooms, portabella, grilled		NS	4	0.337	0.084	60	0.5 cup, whole	0.202
Mushrooms, shiitake, stir-fried		NS	4	0.327	0.098	48	0.5 cup, sliced	0.157
Mushrooms, white		NS	4	0.385	0.029	38	0.5 cup, whole	0.146
Mushrooms, white, microwave cooked		NS	4	0.434	0.262	31	0.5 cup, whole	0.134

(Continued)



TABLE 6 (Continued)

Product ²	Brand ³	Type ⁴	n	Antioxidant	SD or range	Servings	Serving description ⁵	Antioxidant
				content		size ⁵		content
				mmol/100 g		g		mmol/serving
Mushrooms, white, stir-fried		NS	4	0.234	0.021	54	0.5 cup, sliced	0.126
Onions, yellow		NS	4	0.236	0.025	80	0.5 cup chopped	0.189
Onions, yellow, cooked		NS	4	0.259	0.021	43	0.5 cup	0.111
Peppers, green		NS	4	0.262	0.071	74.5	0.5 cup chopped	0.195
Peppers, green, cooked		NS	4	1.223	0.180	50	0.5 cup	0.612
Peppers, red		NS	4	0.910	0.101	74.5	0.5 cup chopped	0.678
Peppers, red, cooked		NS	4	1.640	0.059	50	0.5 cup	0.820
Potatoes, red		NS	4	0.221	0.076	173	1 medium	0.383
Potatoes, red, cooked		NS	8	0.449	0.046	213	1 medium	0.956
Potatoes, russet		NS	4	0.417	0.168	213	1 medium	0.889
Potatoes, russet, cooked		NS	7	0.498	0.107	173	1 medium	0.862
Potatoes, white		NS	3	0.186	0.023	173	1 medium	0.321
Potatoes, white, cooked		NS	7	0.431	0.081	213	1 medium	0.918
Radishes		NS	7	0.110	0.115	116	1 cup sliced	0.127
Spinach, chopped, frozen	Store brand	NS	6	0.986	0.060	78	0.5 cup	0.769
Spinach, chopped, frozen	Birds Eye	NS	1	0.995	-	78	0.5 cup	0.776
Spinach, chopped, frozen	Green Giant	NS	1	1.014	-	78	0.5 cup	0.791
Spinach, chopped, frozen, boiled	Store brand	NS	2	0.990	0.990–0.990	99	0.5 cup	0.980
Spinach, chopped, frozen, boiled	Birds Eye	NS	1	1.134	-	99	0.5 cup	1.123
Spinach, chopped, frozen, microwave cooked	Store brand	NS	2	1.096	1.086–1.106	102	0.5 cup	1.118
Spinach, chopped, frozen, microwave cooked	Birds Eye	NS	1	1.206	-	102	0.5 cup	1.230
Spinach, frozen	Birds Eye	NS	2	1.309	1.267–1.351	78	0.5 cup	1.021
Spinach, frozen	Store brand	NS	4	1.169	0.074	78	0.5 cup	0.912
Spinach, frozen, boiled	Birds Eye	NS	1	1.111	-	99	0.5 cup	1.100
Spinach, frozen, boiled	Store brand	NS	2	1.102	1.086–1.117	99	0.5 cup	1.090
Spinach, frozen, microwave cooked	Birds Eye	NS	1	1.349	-	99	0.5 cup	1.336
Spinach, frozen, microwave cooked, store brand	Store brand	NS	2	1.315	1.233–1.396	102	0.5 cup	1.341
Sweet onions		NS	8	0.147	0.008	80	0.5 cup chopped	0.117
Sweet potatoes		NS	4	0.080	0.015	130	1 medium potato	0.104
Sweet potatoes, baked		NS	4	0.790	0.202	114	1 medium potato	0.900
Sweet potatoes, boiled		NS	4	0.330	0.056	151	1 medium potato (5-in long)	0.498
Tomatoes		NS	8	0.155	0.052	123	1 medium	0.191
Tomatoes, cooked		NS	8	0.222	0.075	123	1 medium	0.273

¹ NLEA, Nutrition Labeling and Education Act; SR17, Standard Release 17.

² All fruit, vegetables, and processed products were not cooked, unless otherwise noted; distilled deionized water was used to prepare products that required water, unless otherwise specified.

³ Inclusion of brand names and product trademarks does not imply endorsement by the authors, and these products are reported as descriptive information for research applications.

⁴ S, samples received directly from supplier; L, samples purchased at a single outlet; NS, nationally sampled.

⁵ Determined from the USDA National Nutrient Database for Standard Reference (36), the US Food and Drug Association NLEA guidelines (37), or actual measurement of average portion weights taken during sample preparation. All serving sizes for fast foods were based on measurements of the samples. 1 tsp = 5 mL. 1 tbsp = 15 mL or 20 g. 1 cup = 240 mL. 1 lb = 0.45 kg, 1 in = 25.4 mm.

serving size. Most of the samples (609 food products) contained between 0.1 and 1.0 mmol/serving. Many samples contained <0.1 mmol/serving (424 food products).

Correlation between different methods for measuring antioxidants

Wu et al (34) previously reported antioxidant values for 172 foods (primarily fruit, vegetables, nuts, and spices) from the

NFNAP, of which 93 overlapped with the samples analyzed in this study. They used both a lipophilic oxygen radical absorbance capacity (L-ORAC) assay and a hydrophilic ORAC (H-ORAC) assay. The antioxidant content was calculated as the sum of the values obtained with the L-ORAC and H-ORAC assays. Wu et al measured the total phenolic contents of the products by the Folin-Ciocalteu reagent. Pearson's correlation coefficients between the antioxidant values reported in the present study and the total



antioxidant capacity (ie, sum of L-ORAC and H-ORAC assays), L-ORAC, H-ORAC, and total phenolics values of the 93 similar items as determined by Wu et al (34) were 0.788 ($y = 0.0221x - 1.7626$; $R^2 = 0.6225$), 0.823 ($y = 0.0550x - 1.5841$; $R^2 = 0.6758$), 0.579 ($y = 0.0221x - 0.5704$; $R^2 = 0.3337$), and 0.496 ($y = 0.2735x - 1.4542$; $R^2 = 0.2435$), respectively.

DISCUSSION

The present results of the analysis of 1120 food samples that were obtained from the USDA National Food and Nutrient Analysis Program represent by far the largest published systematic screening of antioxidants in dietary items, including a wide range of both processed foods and fresh fruit and vegetables. Our results are in generally good agreement with those from earlier smaller-scale analyses that used various methods for estimating the total antioxidant contents of foods (28, 29, 34, 38–42). Collectively these data suggest that certain spices, berries, fruits, nuts, chocolate-containing products, vegetables, and cereals are good sources of dietary antioxidants. Additionally, the drinks coffee, green and black tea, red wine, and various berry and fruit juices are good sources of antioxidants.

It should be kept in mind that such antioxidant analyses estimate the content of many hundreds, probably thousands of different compounds belonging to several molecular families. These antioxidants may have very different absorption properties in humans and their transport to, and within, tissues is likely to vary. The antioxidant food table can therefore not be used for dietary recommendations at the present stage. It is necessary to test whether foods rich in antioxidants have the ability to reduce oxidative stress and to reduce the risk of diseases related to oxidative stress.

It is well known that different extraction methods and types of oxidants can produce different estimates of antioxidant content. Although we specifically selected work-up and analysis procedures aimed at including as many antioxidant species as possible in our antioxidant estimate, there may be specific antioxidants that were not detected in the analysis because of limited extractability from the food matrix or low reactivity against the oxidant (eg, reduction potential below that of the assay or slow reaction kinetics).

Plants produce a large diversity of >100 000 low-molecular-weight compounds known as secondary metabolites (43). Secondary metabolites are distinct from the components of intermediary (primary) metabolism in that they are nonessential for the basic metabolic processes of the plant. Most of these secondary metabolites are redox-active compounds (43, 44) that will be picked up by the FRAP assay used in the present study. This diversity of secondary metabolites results from an evolutionary process driven by selection for improved defense against microbial attack, insect or animal predation, ultraviolet light or drought related stress, or other stress factors (44). The phytoanticipins are compounds that are synthesized at a constant rate, whereas phytoalexins are compounds that are more actively synthesized during various types of stress (43, 44). Our food table, therefore, not only represents the amounts of antioxidants in foods, it also identifies those plant foods containing the highest concentrations of secondary plant metabolites. Some of the ambiguity in the interpretation of our table of antioxidant-rich foods relates to

other potential stress-reducing effects of phytoalexins and phytoanticipins beyond those directly related to their ability to participate in redox reactions. Thus, in future studies, if any of the plant-based foods that are ranked highest in our food table are proven to be beneficial and reduce stress related-diseases in humans, care should be taken to distinguish such beneficial actions due to their role as redox-active antioxidants from their activity as modulators of specific molecular events in human cells, such as regulation of protein kinases, acetylases, deacetylases, and transcription factors.


Some initial experimental dietary studies support the beneficial effect of dietary plants rich in antioxidants. Pomegranate is a fruit that is extremely rich in antioxidants (28). Aviram et al (45, 46) showed that pomegranate juice administered orally to apolipoprotein E-deficient atherosclerotic mice decreases macrophage lipid peroxidation, LDL susceptibility to oxidation, aggregation and retention, cellular cholesterol accumulation, and development of atherosclerosis. In small-scale human studies they observed that pomegranate juice increased the activity of serum paraoxonase (an HDL-associated esterase that can protect against lipid peroxidation), inhibited serum angiotensin-converting enzyme activity, and reduced systolic blood pressure in hypertensive patients (45, 47). Finally, pomegranate juice consumption for 3 y by patients with carotid artery stenosis reduced common carotid intima-media thickness, blood pressure, and LDL oxidation (48).

Walnuts contain even more antioxidants than do pomegranates (Table 6). The high antioxidant content of walnuts may be related to the observation that walnuts are unique compared with most other nuts, which contain monounsaturated fatty acids, because walnuts are rich in n-6 (linoleate) and n-3 (linolenate) polyunsaturated fatty acids. Five short-term walnut-intervention trials in subjects at risk of coronary heart disease consistently show that walnuts, as part of a heart-healthy diet, lower blood cholesterol concentrations (reviewed in references 49 and 50). These results are supported by several large prospective observational studies in humans, all of which showed a dose response-related inverse association of the relative risk of coronary heart disease with frequent daily consumption of small amounts of nuts, including walnuts (51). In addition, Ros et al (52) recently showed that a walnut diet improves endothelial function in hypercholesterolemic subjects. In March 2004, the FDA accepted the following qualified health claim about walnuts: "Supportive but not conclusive research shows that eating 1.5 ounces per day of walnuts, as part of a low saturated fat and low cholesterol diet and not resulting in increased caloric intake may reduce the risk of coronary heart disease" (53). We suggest that a high antioxidant concentration as well as a favorable polyunsaturated fatty acid pattern may contribute to the beneficial health effects of walnuts.

Serafini et al (54) calculated the total dietary antioxidant intake based on ORAC analysis of 11 antioxidant-rich fruit and vegetables in a population-based case-control study, from which data were collected from 505 newly diagnosed gastric adenocarcinoma patients and 1116 control subjects. They observed that intake of antioxidant equivalents was inversely associated with the risk of both gastric cancers of the cardia and of the distal regions (odds ratio: 0.65; 95% CI: 0.48, 0.89 for the highest quartile of antioxidant intake). Never-smokers with the highest antioxidant intake had the lowest risk of cancer (odds ratio: 0.44;

95% CI: 0.27, 0.71). Among *Helicobacter pylori*-infected subjects, the odds ratio varied between 0.66 and 0.41 for quartiles 2–4 compared with the lowest quartile of antioxidant intake (54). The extensive antioxidant table we now present (Table 6) provides a useful tool for further epidemiologic investigations into the possible health benefit of dietary antioxidants.

Because an extensive antioxidant table was not previously available, Wright et al (55) constructed a dietary antioxidant index and evaluated its ability to predict lung cancer risk within the Alpha-Tocopherol Beta-Carotene Cancer Prevention Study cohort. The summation of principal component scores derived from individual food analyses of the carotenoid, flavonoid, and vitamin E nutrient groups, plus selenium and ascorbic acid, yielded the composite antioxidant index. At baseline (1985–1988), 27 111 Finnish male smokers aged 50–69 y completed a dietary questionnaire that assessed usual frequency of consumption and portion sizes for the previous 12 mo. A total of 1787 incident cases of lung cancer were identified during a follow-up period of up to 14.4 y (1985–1999). In multivariate proportional hazards models, the relative risks for lung cancer according to increasing quintiles of the antioxidant index were 1.00 (referent), 1.00 (95% CI: 0.87, 1.14), 0.91 (95% CI: 0.79, 1.05), 0.79 (95% CI: 0.68, 0.92), and 0.84 (95% CI: 0.72, 0.98) (P for trend = 0.002), which suggested that a high antioxidant intake is inversely related to lung cancer risk (55).

These preliminary studies suggest a beneficial health effect of consuming dietary plants rich in antioxidants. The overall evidence, however, is limited and much more research is needed. Our extensive total antioxidant food table should be useful for further testing of the antioxidant hypothesis. 

We thank Amy Rasor and Nancy Conley for preparing, shipping, and maintaining the sample descriptive information.

MHC had full access to all of the data in the study and took responsibility for the integrity of the data and the accuracy of the data analysis. RB was responsible for the study concept and design, supervision, and drafting of the manuscript. BLH, MHC, KMP, SKB, and KH were responsible for data acquisition. All authors participated in the analysis and interpretation of the data and the critical revision of the manuscript for important intellectual content. None of the authors had a personal or financial conflict of interest. DRJ is an unpaid member of the Scientific Advisory Council of the California Walnut Commission.

REFERENCES

- Demmig-Adams B, Adams WW III. Antioxidants in photosynthesis and human nutrition. *Science* 2002;298:2149–53.
- Benzie IF. Evolution of dietary antioxidants. *Comp Biochem Physiol* 2003;136:113–26.
- Bandyopadhyay D, Chattopadhyay A, Ghosh G, Datta AG. Oxidative stress-induced ischemic heart disease: protection by antioxidants. *Curr Med Chem* 2004;11:369–87.
- Griendling KK, FitzGerald GA. Oxidative stress and cardiovascular injury: part II: animal and human studies. *Circulation* 2003;108:2034–40.
- Sanchez-Quesada JL, Benitez S, Ordonez-Llanos J. Electronegative low-density lipoprotein. *Curr Opin Lipidol* 2004;15:329–35.
- McCord JM. The evolution of free radicals and oxidative stress. *Am J Med* 2000;108:652–9.
- World Cancer Research Fund, American Institute for Cancer Research. Food, nutrition and the prevention of cancer: a global perspective. Washington, DC: American Institute for Cancer Research, 1997.
- Report of the joint WHO/FAO Expert Consultation. Diet, nutrition and the prevention of chronic diseases. *World Health Organ Tech Rep Ser* 2003;916.
- Brigelius-Flohe R, Kelly FJ, Salonen JT, Neuzil J, Zingg JM, Azzi A. The European perspective on vitamin E: current knowledge and future research. *Am J Clin Nutr* 2002;76:703–16.
- Cooper DA. Carotenoids in health and disease: recent scientific evaluations, research recommendations and the consumer. *J Nutr* 2004;134(suppl):221S–4S.
- Stanner SA, Hughes J, Kelly CN, Buttriss J. A review of the epidemiological evidence for the 'antioxidant hypothesis.' *Public Health Nutr* 2004;7:407–22.
- Albanes D, Heinonen OP, Taylor PR, et al. Alpha-tocopherol and beta-carotene supplements and lung cancer incidence in the alpha-tocopherol, beta-carotene cancer prevention study: effects of base-line characteristics and study compliance. *J Natl Cancer Inst* 1996;88:1560–70.
- Omenn GS, Goodman GE, Thornquist MD, et al. Risk factors for lung cancer and for intervention effects in CARET, the Beta-Carotene and Retinol Efficacy Trial. *J Natl Cancer Inst* 1996;88:1550–9.
- Omenn GS, Goodman GE, Thornquist MD, et al. Effects of a combination of beta carotene and vitamin A on lung cancer and cardiovascular disease. *N Engl J Med* 1996;334:1150–5.
- Rapola JM, Virtamo J, Ripatti S, et al. Randomised trial of alpha-tocopherol and beta-carotene supplements on incidence of major coronary events in men with previous myocardial infarction. *Lancet* 1997;349:1715–20.
- Eidelman RS, Hollar D, Hebert PR, Lamas GA, Hennekens CH. Randomized trials of vitamin E in the treatment and prevention of cardiovascular disease. *Arch Intern Med* 2004;164:1552–6.
- Shekelle PG, Morton SC, Jungvig LK, et al. Effect of supplemental vitamin E for the prevention and treatment of cardiovascular disease. *J Gen Intern Med* 2004;19:380–9.
- Vivekananthan DP, Penn MS, Sapp SK, Hsu A, Topol EJ. Use of antioxidant vitamins for the prevention of cardiovascular disease: meta-analysis of randomised trials. *Lancet* 2003;361:2017–23.
- Lindsay DG, Astley SB. European research on the functional effects of dietary antioxidants—EUROFEDA. *Mol Aspects Med* 2002;23:1–38.
- Packer L, Weber SU, Rimbach G. Molecular aspects of alpha-tocotrienol antioxidant action and cell signalling. *J Nutr* 2001;131(suppl):369S–73S.
- Buettner GR. The pecking order of free radicals and antioxidants: lipid peroxidation, alpha-tocopherol, and ascorbate. *Arch Biochem Biophys* 1993;300:535–43.
- Schafer FQ, Buettner GR. Redox environment of the cell as viewed through the redox state of the glutathione disulfide/glutathione couple. *Free Radic Biol Med* 2001;30:1191–212.
- Miller NJ, Rice-Evans CA. Spectrophotometric determination of antioxidant activity. *Redox Rep* 1996;2:161–8.
- DeLange RJ, Glazer AN. Phycoerythrin fluorescence-based assay for peroxy radicals: a screen for biologically relevant protective agents. *Anal Biochem* 1989;177:300–6.
- Cao G, Alessio HM, Cutler RG. Oxygen-radical absorbance capacity assay for antioxidants. *Free Radic Biol Med* 1993;14:303–11.
- Benzie IFF, Strain JJ. The ferric reducing ability of plasma (FRAP) as a measure of "antioxidant power": the FRAP assay. *Anal Biochem* 1996;239:70–6.
- Blomhoff R. Dietary antioxidants and cardiovascular disease. *Curr Opin Lipidol* 2005;16:47–54.
- Halvorsen BL, Holte K, Myhrstad MC, et al. A systematic screening of total antioxidants in dietary plants. *J Nutr* 2002;132:461–71.
- Dragland S, Senoo H, Wake K, Holte K, Blomhoff R. Several culinary and medicinal herbs are important sources of dietary antioxidants. *J Nutr* 2003;133:1286–90.
- Pehrsson PR, Haytowitz DB, Holden JM. The USDA's National Food and Nutrient Analysis Program: update 2002. *J Food Comp Anal* 2003;16:331–41.
- Pehrsson PR, Haytowitz DB, Holden JM, Perry CR, Beckler DG. USDA's National Food and Nutrient Analysis Program: food sampling. *J Food Comp Anal* 2000;12:379–89.
- Perry CR, Pehrsson PR, Holden J. A revised sampling plan for obtaining food products for nutrient analysis for the USDA National Nutrient Database. Proceedings of the American Statistical Association, Section on Survey Research Methods. Alexandria, VA: American Statistical Association, 2003 (CD-ROM).
- Perry CP, Beckler DG, Pehrsson PR, Holden J. A national sampling plan for obtaining food products for nutrient analysis. Proceedings of the 2000 Joint Statistical Meetings. Indianapolis, IN: American Statistical Association, 2001:267–72.
- Wu X, Beecher GR, Holden JM, Haytowitz DB, Gebhardt SE, Prior RL.

- Lipophilic and hydrophilic antioxidant capacities of common foods in the United States. *J Agric Food Chem* 2004;52:4016–37.
35. Phillips KM, Patterson KY, Rasor AY, et al. Quality-control materials in the USDA National Food and Nutrient Analysis Program (NFNAP). *Anal Biochem* 2006;384:1341–55.
 36. US Department of Agriculture, Agricultural Research Service. 2004. USDA National Nutrient Database for Standard Reference, release 17. Internet: <http://www.ars.usda.gov/Services/docs.htm?docid=9694> (accessed 8 May 2006).
 37. US Food and Drug Administration. 2002. Code of Federal Regulations: 21CFR101.12, pages 47-56. Reference amounts customarily consumed per eating occasion. US Government Printing Office. Internet: <http://www.cfsan.fda.gov/~lrd/cf101-12.html> (accessed 4 May 2006).
 38. Cao G, Sofic E, Prior RL. Antioxidant capacity of tea and common vegetables. *J Agric Food Chem* 1996;4:3426–31.
 39. Wang H, Cao G, Prior RL. Total antioxidant capacity of fruits. *J Agric Food Chem* 1996;44:701–5.
 40. Miller HE, Rigelhof F, Marquart L, Prakash A, Kanter M. Antioxidant content of whole grain breakfast cereals, fruits and vegetables *J Am Coll Nutr* 2000;19(suppl):312S–9S.
 41. Sun J, Chu YF, Wu X, Liu RH. Antioxidant and antiproliferative activities of common fruits. *J Agric Food Chem* 2002;50:7449–54.
 42. Prottogente AR, Pannala AS, Paganga G, et al. The antioxidant activity of regularly consumed fruit and vegetables reflects their phenolic and vitamin C composition. *Free Radic Res* 2002;36:217–33.
 43. Dixon RA. Natural products and plant disease resistance. *Nature* 2001;411(6839):843–7.
 44. Pichersky E, Gang DR. Genetics and biochemistry of secondary metabolites in plants: an evolutionary perspective. *Trends Plant Sci* 2000;5:439–45.
 45. Aviram M, Dornfeld L, Rosenblat M, et al. Pomegranate juice consumption reduces oxidative stress, atherogenic modifications to LDL, and platelet aggregation: studies in humans and in atherosclerotic apolipoprotein E-deficient mice. *Am J Clin Nutr* 2000;71:1062–76.
 46. Kaplan M, Hayek T, Raz A, et al. Pomegranate juice supplementation to atherosclerotic mice reduces macrophage lipid peroxidation, cellular cholesterol accumulation and development of atherosclerosis. *J Nutr* 2001;131:2082–9.
 47. Aviram M, Dornfeld L. Pomegranate juice consumption inhibits serum angiotensin converting enzyme activity and reduces systolic blood pressure. *Atherosclerosis* 2001;158:195–8.
 48. Aviram M, Rosenblat M, Gaitini D, et al. Pomegranate juice consumption for 3 years by patients with carotid artery stenosis reduces common carotid intima-media thickness, blood pressure and LDL oxidation. *Clin Nutr* 2004;23:423–33.
 49. Feldman EB. The scientific evidence for a beneficial health relationship between walnuts and coronary heart disease. *J Nutr* 2002;132(suppl):1062S–101S.
 50. Anderson KJ, Teuber SS, Gobeille A, Cremin P, Waterhouse AL, Steinberg FM. Walnut polyphenolics inhibit in vitro human plasma and LDL oxidation. *J Nutr* 2001;131:2837–42.
 51. Sabat J. Nut consumption, vegetarian diets, ischemic heart disease risk and all-cause mortality: evidence from epidemiological studies. *J Nutr* 1999;70:500–3.
 52. Ros E, Nunez I, Perez-Heras A, et al. A walnut diet improves endothelial function in hypercholesterolemic subjects: a randomized crossover trial. *Circulation* 2004;109:1609–14.
 53. US Food and Drug Administration. March 2004. Qualified health claims: letter of enforcement discretion—walnuts and coronary heart disease. Docket no. 02P-0292. Internet: www.cfsan.fda.gov/~dms/qhcnuts3.html (accessed 4 May 2006).
 54. Serafini M, Bellocchio R, Wolk A, Ekstrom AM. Total antioxidant potential of fruit and vegetables and risk of gastric cancer. *Gastroenterology* 2002;123:985–91.
 55. Wright ME, Mayne ST, Stolzenberg-Solomon RZ, et al. Development of a comprehensive dietary antioxidant index and application to lung cancer risk in a cohort of male smokers. *Am J Epidemiol* 2004;160:68–76.

