Vitamin, Mineral, and Proximate Composition of Frozen Fruits, Juices, and Vegetables

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Eight vitamins, six minerals, and proximate composition were determined on composites of 796 sets of samples representing 1953 and 1954 production seasons for 14 frozen fruits, 7 frozen juices, and 30 frozen vegetables in the continental United States and Hawaii. The total number of individual packages used in testing was 27,562. These packages were taken from commercial processing lines of more than 150 freezing plants in all production areas. They were taken at statistically predetermined intervals to provide for representative sampling with regard to variables in weather, varieties, harvesting, processing, packaging, and grades. Substantial amounts of ascorbic acid were found in all citrus juices, in practically all fruits, and in most vegetable products. Many of the products contained low levels of sodium. Data available in the literature on nutrients in frozen foods are limited. This report will markedly supplement the literature on the nutritional composition of frozen foods.

ALTHOUGH EXTENSIVE QUANTITATIVE DATA are available on the nutrient composition of fresh and most processed foods, relatively limited information has been published on nutrients in frozen food products. Improvements in assay methods and production techniques may have made some of these values obsolete. In consideration of the need for adequate information of this type, the National Association of Frozen Food Packers has undertaken the sponsorship of a comprehensive program in nutritional research. In this report results are given on the

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Table I. Vitamin, Proximate, and

(Average value, followed

	Sets Tested	Ascorbic Acid			Vitamins, Mg./100 Grams						
		Reduced	Dehydro	Total	β-Carotene	Folic acid	Niacin	Pantothenic acid	Riboflavin	Thiamine	Vitamin B_6
											14 Frozen
Apples, sliced	7	5.7	1.6	7.3	0.01	0.002	0.21	0.114	0.03	0.01	0.030
		8.6	3.7	9.6	0.02	0.004	0.34	0.175	0.06	0.01	0.042
		3.6	<0.1	5.8	0.01	0.001	0.16	0.073	0.02	0.01	0.013
Apricots	6	6.6	20.9	27.5[a]	1.01	0.003	0.78	0.173	0.04	0.02	0.071
		22.0	78.2	100.3	1.50	0.004	1.05	0.217	0.06	0.03	0.114
		0.0	2.0	6.1	0.55	0.001	0.63	0.100	0.03	0.01	0.052
Blueberries, cultivated											
Sweetened	2	1.1	7.4	8.5	0.02	0.008	0.37	0.121	0.05	0.04	0.091
		1.2	8.3	9.2	0.02	0.008	0.38	0.123	0.06	0.04	0.123
		0.9	6.6	7.8	0.01	0.007	0.36	0.118	0.04	0.03	0.059
Unsweetened	4	1.9	5.4	7.3	0.04	0.008	0.46	0.168	0.06	0.03	0.040
		2.9	6.6	8.0	0.06	0.010	0.55	0.225	0.07	0.04	0.061
		1.4	4.0	6.7	0.03	0.005	0.38	0.134	0.06	0.02	0.026
Boysenberries	3	4.8	2.9	7.7	0.02	0.013	0.64	0.202	0.10	0.02	0.042
		5.8	3.4	9.1	0.03	0.018	0.70	0.353	0.13	0.02	0.076
		3.0	1.9	4.9	0.01	0.008	0.54	0.098	0.08	0.02	0.024
Unsweetened	3	8.4	4.2	12.6	0.02	0.029	0.96	0.224	0.13	0.02	0.059
		12.3	12.3	16.0	0.03	0.032	1.50	0.268	0.18	0.03	0.087
		3.7	0.2	9.4	0.02	0.025	0.62	0.183	0.10	0.02	0.035
Cherries, red sour											
Pitted	5	1.4	4.7	6.1	0.29	0.005	0.32	0.083	0.06	0.03	0.058
		2.7	7.8	8.6	0.44	0.006	0.39	0.128	0.07	0.04	0.079
		0.7	3.4	4.2	0.20	0.002	0.26	0.045	0.03	0.03	0.043
Unsweetened	2	0.9	4.0	4.9	0.65	0.006	0.30	0.071	0.07	0.04	0.085
		0.9	5.1	5.9	0.76	0.007	0.32	0.088	0.07	0.04	0.103
		0.8	3.0	4.0	0.54	0.005	0.27	0.053	0.07	0.03	0.067
Peaches, sliced	20	10.1	29.7	39.8[a]	0.07	0.004	0.71	0.118	0.04	0.01	0.020
		28.4	49.1	76.1	0.11	0.018	0.98	0.146	0.05	0.03	0.053
		0.0	6.8	11.2	0.05	0.001	0.30	0.096	0.03	0.01	0.007

determination of the nutrient composition of 51 frozen fruit, juice, and vegetable products in terms of eight vitamins, six minerals, and six proximate components plus computed calorie values.

Sampling

The statistical sampling plan employed has been described by Schmitt and Jessen (*20*). Over-all sampling was related to volume of production in more than 150 freezing plants in all regions of the continental United States and Hawaii. The samples were collected in 796 sets, each of which consisted of a number of packages of a given product taken from regular commercial production of a single freezing plant at statistically predetermined intervals of operation. This provided for a representative sampling with respect to variables in weather, varieties, harvesting, processing, packaging, and grades. The average number of packages per set was 34.6. From the 1953 packing season, 348 sets were taken; from the 1954 season, 448 sets. In general, packages were of retail or consumer size, although some apple, apricot, blueberry, boysenberry, and peach, and a few vegetable packages were of institutional size. The coded sets were collected and shipped under 0° F. refrigeration to a cold storage warehouse in Madison, Wis. Samples for analysis were removed from the warehouse only as needed.

The average age of the samples was determined as the elapsed time from the midpoint of seasonal production to the date of sample preparation at the laboratory. This sample age was found to be 6.8 months, which is a good approximation of the average of frozen foods purchased in the retail market. However, it is recognized that conditions of commercial handling between packer and consumer have not been perfectly duplicated in this study.

Sample Preparation

The samples were removed from storage at 0° F. and ground immediately in a Hussmann-Ligonier meat grinder, which was constructed with an aluminum screw and housing, stainless steel plates, and stainless steel knives with hardened iron blade inserts. Moderate amounts of iron (less than 1 mg. per 100 grams of food) were introduced into the vegetable samples by abrasion of the blades. Total iron values reported herein for vegetables have been corrected accordingly.

The ground material was collected in stainless steel or tin-plated 30-quart bowls and stirred with a Hobart mixer to provide a homogeneous preparation. Ascorbic acid assays were performed immediately. Other determinations were made as expeditiously as possible (usually the same day) on aliquots of the composites which were stored in the frozen state. Only the edible portion of corn-on-cob samples was tested.

Assay Methods

Reduced and total ascorbic acid were determined by the photometric method of Rubin, Jahns, and Bauernfeind (*18*). In pilot studies this method gave results which agreed favorably with those obtained by the method of Roe and others (*17*). The values for dehydroascorbic acid were calculated. Samples for β-carotene assay were continuously extracted with acetone for 4 hours. The acetone was removed under vacuum and the residue was taken up in Skellysolve B (petroleum fraction, 60° to 65° C.). The solution was washed with saturated sodium chloride solution and subjected to chromatography and colorimetry according to published procedures (*3*). A special extraction procedure, performed by shaking with a mixture of

Mineral Composition of Frozen Foods

by maximum and minimum)

Proximate Composition							Minerals, Mg./100 Grams					
Solids, %	Ash, %	Ether extract, %	Protein, %	Carbohydrate, % Crude fiber	Carbohydrate, % Total by difference	Calories/100 g., Atwater system	Calcium	Total iron	Phosphorus	Magnesium	Potassium	Sodium
Fruit Products												
24.9	0.34	0.12	0.19	0.69	24.3	92	4.6	0.5	6.2	4.1	68	66.0[a]
33.4	0.69	0.20	0.31	0.85	32.8	124	8.8	0.7	8.0	5.5	83	200.0
21.3	0.11	0.05	0.11	0.58	20.7	79	1.5	0.3	4.7	2.9	45	2.2
26.7	0.81	0.09	0.66	0.57	25.2	98	9.6	0.9	19.0	9.0	229	3.9
28.6	1.89	0.14	0.80	0.69	27.5	106	10.9	1.2	21.0	11.0	254	11.6
23.5	0.36	0.06	0.52	0.46	22.1	86	7.6	0.7	17.0	7.5	200	0.8
27.7	0.27	0.26	0.60	0.89	26.6	104	6.2	0.4	11.0	4.5	66	0.5
27.7	0.38	0.37	0.81	0.95	26.8	105	6.8	0.4	12.0	4.6	68	0.5
27.6	0.16	0.14	0.38	0.83	26.3	103	5.7	0.4	11.0	4.4	64	0.5
15.0	0.18	0.49	0.72	1.50	13.7	56	9.6	0.8	13.0	5.9	81	0.5
16.0	0.25	0.69	1.54	1.85	14.8	60	11.9	0.9	15.0	6.6	104	0.8
13.3	0.15	0.27	0.21	1.20	12.2	49	8.3	0.6	11.0	5.5	54	0.3
25.7	0.24	0.30	0.79	1.83	24.4	96	17.0	0.6	17.0	12.0	105	1.1
27.7	0.33	0.44	0.94	2.14	26.2	103	20.0	0.7	19.0	14.0	122	1.5
22.3	0.18	0.22	0.71	1.44	20.9	84	15.0	0.5	15.0	11.0	87	0.5
13.2	0.34	0.34	1.20	2.73	11.3	48	25.0	1.6	24.0	18.0	153	0.7
14.2	0.40	0.43	1.49	3.19	12.3	51	29.0	2.3	26.0	20.0	169	1.0
12.6	0.25	0.26	0.92	2.21	10.7	46	22.0	1.2	20.0	15.0	132	0.4
29.4	0.23	0.37	1.02	0.23	27.8	111	12.0	0.5	15.0	7.5	130	0.7
32.6	0.31	0.51	1.75	0.25	31.0	124	13.0	0.6	18.0	8.6	150	1.8
28.1	0.18	0.18	0.72	0.19	25.8	105	10.0	0.4	11.0	6.6	120	0.3
15.1	0.34	0.45	1.00	0.27	13.3	55	13.0	0.7	22.0	9.6	188	0.3
15.1	0.44	0.57	1.09	0.27	13.4	56	13.0	0.8	24.0	11.1	197	0.3
15.0	0.23	0.32	0.91	0.26	13.2	54	13.0	0.6	21.0	8.1	178	0.3
23.5	0.42	0.08	0.43	0.38	22.6	87	3.7	0.5	13.0	5.9	124	2.0
26.9	1.99	0.16	0.64	0.50	26.0	101	5.2	1.2	14.0	8.9	155	5.1
20.8	0.12	0.02	0.28	0.30	19.7	77	2.4	0.3	10.0	4.6	93	0.5

Table I. Vitamin, Proximate, and Mineral

(Average value, followed

	Sets Tested	Ascorbic Acid			Vitamins, Mg./100 Grams						
		Reduced	Dehydro	Total	β-Carotene	Folic acid	Niacin	Pantothenic acid	Riboflavin	Thiamine	Vitamin B_6
											14 Frozen Fruit
Pineapple chunks	5	7.0	1.2	8.2	0.02	0.006	0.28	0.105	0.03	0.10	0.075
		7.9	1.7	8.8	0.02	0.008	0.30	0.145	0.04	0.12	0.093
		6.1	0.3	7.7	0.01	0.003	0.23	0.074	0.02	0.06	0.055
Raspberries, red	13	18.6	2.2	20.8	0.02	0.005	0.61	0.207	0.06	0.02	0.038
		31.3	15.8	33.1	0.05	0.014	0.78	0.313	0.10	0.03	0.065
		12.3	0.1	12.4	0.01	0.001	0.45	0.156	0.04	0.01	0.024
Rhubarb	8	6.4	1.2	7.6	0.05	0.004	0.23	0.069	0.05	0.02	0.029
		10.2	2.7	10.9	0.07	0.008	0.30	0.106	0.09	0.02	0.041
		3.9	0.4	4.8	0.03	0.002	0.18	0.055	0.03	0.01	0.020
Strawberries											
Sliced	35	42.3	11.1	53.4	0.02	0.009	0.52	0.156	0.06	0.02	0.061
		61.6	26.7	70.7	0.05	0.017	0.75	0.224	0.09	0.03	0.143
		15.8	3.7	19.6	0.01	0.002	0.35	0.083	0.05	0.01	0.025
Whole	7	43.1	12.3	55.4	0.02	0.004	0.50	0.115	0.06	0.02	0.052
		54.1	31.2	66.6	0.03	0.010	0.70	0.158	0.06	0.02	0.083
		34.5	6.9	43.2	0.01	0.002	0.37	0.077	0.05	0.01	0.027
											7 Frozen
Grape juice, sweetened	10	2.5	1.8	4.3	0.003	0.003	0.20	0.040	0.027	0.019	0.021
		5.9	2.6	7.2	0.003	0.005	0.26	0.048	0.035	0.023	0.026
		1.6	1.3	3.0	0.003	0.002	0.14	0.025	0.020	0.017	0.014
Grapefruit juice	8	36.1	2.0	38.1	0.004	0.002	0.26	0.162	0.006	0.048	0.014
		41.5	5.5	43.3	0.006	0.003	0.34	0.197	0.007	0.057	0.015
		31.5	0.1	34.6	0.003	0.001	0.21	0.120	0.004	0.040	0.012
Lemon juice, single strength	3	41.8	2.2	44.0	<0.01	0.001	0.12	0.086	0.012	0.030	0.039
		44.8	5.6	45.8	<0.01	0.001	0.13	0.098	0.014	0.040	0.043
		40.2	<0.1	41.5	<0.01	0.001	0.10	0.078	0.007	0.030	0.037
Lemonade, sweetened	13	6.3	0.5	6.8	Trace	Trace	0.07	0.011	0.006	0.005	0.005
		9.1	1.7	9.6	Trace	Trace	0.09	0.016	0.007	0.007	0.007
		3.9	<0.1	4.1	Trace	Trace	0.02	0.007	0.004	0.004	0.004
Orange juice	46	46.1	1.1	47.2	0.005	0.003	0.33	0.155	0.013	0.085	0.033
		50.8	3.7	54.5	0.014	0.005	0.50	0.178	0.026	0.097	0.054
		35.7	<0.1	38.2	0.003	0.002	0.27	0.131	0.009	0.074	0.025
Orange and grapefruit juice	8	41.0	2.1	43.1	0.004	0.003	0.31	0.150	0.008	0.064	0.024
		47.0	3.7	48.7	0.006	0.004	0.39	0.187	0.012	0.074	0.027
		32.3	0.2	34.2	0.003	0.002	0.23	0.118	0.006	0.054	0.020
Pineapple juice	5	11.8	1.2	13.0	0.009	0.001	0.25	0.125	0.016	0.066	0.074
		15.4	2.5	16.6	0.011	0.002	0.29	0.157	0.019	0.069	0.098
		9.2	0.4	11.0	0.006	0.001	0.20	0.094	0.012	0.058	0.053
											30 Frozen
Asparagus											
Cuts and tips	10	23.4	1.8	25.2	0.51	0.063	1.17	0.415	0.14	0.16	0.136
		32.3	4.4	35.6	0.64	0.125	1.57	0.640	0.20	0.20	0.219
		13.9	0.2	18.3	0.43	0.018	0.99	0.265	0.09	0.14	0.056
Spears	18	26.9	2.2	29.1	0.47	0.068	1.26	0.420	0.15	0.18	0.146
		40.6	11.1	40.7	0.55	0.156	1.50	0.574	0.30	0.23	0.187
		6.0	0.0	13.4	0.38	0.025	1.10	0.190	0.10	0.12	0.081
Beans, cut wax	9	9.8	2.2	12.0	0.06	0.023	0.47	0.138	0.09	0.08	0.079
		11.9	3.3	15.0	0.08	0.041	0.58	0.231	0.12	0.10	0.120
		7.9	1.3	9.7	0.03	0.013	0.40	0.076	0.07	0.06	0.056
Beans, green											
Cut	23	7.1	2.3	9.4	0.35	0.020	0.44	0.120	0.10	0.07	0.063
		12.9	9.5	13.0	0.45	0.035	0.52	0.218	0.15	0.09	0.098
		0.5	0.1	5.3	0.26	0.010	0.33	0.069	0.07	0.05	0.041
French style	23	7.5	2.5	10.0	0.32	0.024	0.42	0.120	0.09	0.07	0.070
		13.2	5.7	15.1	0.43	0.048	0.65	0.218	0.13	0.10	0.137
		0.7	1.0	5.6	0.21	0.012	0.28	0.080	0.05	0.04	0.043
Beans, Lima											
Baby	32	17.6	1.2	18.8	0.13	0.016	1.24	0.239	0.06	0.10	0.113
		23.7	3.3	26.0	0.17	0.038	1.70	0.448	0.09	0.15	0.175
		7.7	0.0	7.8	0.07	0.008	0.88	0.151	0.04	0.06	0.054
Fordhook	47	20.4	1.8	22.2	0.14	0.020	1.18	0.210	0.06	0.10	0.170
		24.9	4.0	27.7	0.19	0.049	1.50	0.370	0.08	0.16	0.590
		16.1	0.0	17.3	0.10	0.010	0.74	0.100	0.04	0.06	0.079
Broccoli											
Chopped	15	65.2	4.7	69.9	1.55	0.046	0.55	0.463	0.13	0.07	0.161
		84.3	22.2	93.3	2.74	0.082	0.78	0.722	0.18	0.11	0.257
		37.1	9.0	46.8	0.84	0.026	0.34	0.300	0.09	0.04	0.095

Composition of Frozen Foods (*Continued*)

by maximum and minimum)

Proximate Composition							Minerals, Mg./100 Grams					
				Carbohydrate, %								
Solids, %	Ash, %	Ether extract, %	Protein, %	Crude fiber	Total by difference	Calories/100 g., Atwater system	Calcium	Total iron	Phosphorus	Magnesium	Potassium	Sodium
Products (*Continued*)												
22.9	0.23	0.14	0.37	0.31	22.2	85	8.5	0.4	3.8	10.5	100	2.5
24.8	0.29	0.24	0.41	0.36	24.0	93	9.5	0.5	4.1	11.2	111	4.5
21.4	0.20	0.06	0.36	0.27	20.7	79	6.6	0.3	3.3	9.7	70	0.8
25.7	0.22	0.16	0.69	2.16	24.7	97	12.9	0.6	17.0	11.0	100	0.7
27.7	0.32	0.26	0.76	2.59	26.9	104	16.6	0.7	20.0	13.0	111	0.9
23.6	0.15	0.07	0.54	1.36	22.6	88	7.8	0.4	13.0	10.0	79	0.4
19.9	0.60	0.17	0.57	0.88	18.5	74	93.0	0.8	14.0	12.4	211	3.9
20.7	0.86	0.31	0.82	1.39	19.6	77	148.0	1.0	19.0	21.5	280	12.8
18.8	0.38	0.04	0.37	0.63	17.4	71	57.0	0.5	9.0	7.8	144	0.9
28.7	0.24	0.15	0.51	0.80	27.9	109	14.0	0.7	17.0	8.8	112	1.1
38.2	0.52	0.36	0.64	1.11	37.0	145	19.0	1.1	24.0	11.0	149	5.9
22.9	0.06	0.04	0.37	0.50	21.8	86	10.0	0.4	10.0	6.3	78	0.3
24.3	0.21	0.15	0.45	0.59	23.5	92	13.0	0.6	16.0	8.1	104	1.3
29.1	0.24	0.36	0.60	0.78	28.3	109	15.0	0.8	19.0	9.3	121	2.5
22.2	0.18	0.04	0.35	0.47	21.5	83	10.0	0.5	13.0	6.6	95	0.6
Juice Products												
13.6	0.08	0.01	0.16	0.03	13.4	50	3.0	0.12	4.2	3.5	34	0.8
14.4	0.14	0.01	0.20	0.07	14.1	52	3.6	0.18	5.1	4.6	61	1.0
12.9	0.05	0.01	0.12	0.02	12.6	47	2.4	0.10	3.3	2.3	24	0.5
11.8	0.32	0.04	0.56	0.04	10.9	41	8.0	0.10	12.0	9.2	168	0.3
12.4	0.41	0.07	0.68	0.04	11.6	44	9.0	0.12	15.0	10.2	209	0.5
11.2	0.24	0.02	0.46	0.03	10.0	39	6.4	0.07	11.0	8.4	142	0.3
8.0	0.22	0.23	0.39	0.03	7.1	22	6.8	0.28	9.4	7.4	107	1.3
8.4	0.24	0.25	0.41	0.05	7.6	23	8.3	0.38	9.6	7.9	109	1.4
7.6	0.21	0.13	0.36	0.02	6.6	21	5.3	0.20	9.2	6.8	104	1.3
11.5	0.03	0.01	0.06	0.02	11.4	43	0.9	0.04	1.4	1.2	16	0.5
12.0	0.05	0.03	0.07	0.04	12.0	45	1.5	0.07	1.9	1.4	18	1.8
10.6	0.02	<0.01	0.04	<0.01	10.5	40	0.7	0.02	1.2	0.9	13	0.2
11.8	0.38	0.06	0.65	0.05	10.7	41	9.2	0.12	16.0	10.4	187	0.5[a]
11.9	0.48	0.14	0.99	0.07	10.8	42	11.2	0.16	18.0	13.1	200	4.5
11.5	0.27	0.01	0.57	0.02	10.2	40	7.0	0.09	12.0	8.7	169	0.2
11.6	0.35	0.04	0.58	0.04	10.6	41	8.3	0.11	13.0	9.1	177	0.4
11.9	0.41	0.07	0.64	0.05	10.9	42	9.7	0.16	14.0	10.3	191	1.0
11.3	0.26	0.02	0.51	0.03	10.3	39	6.6	0.09	12.0	8.1	136	0.3
13.8	0.35	0.03	0.41	0.11	13.0	49	10.8	0.32	8.3	8.9	143	0.8
15.1	0.39	0.04	0.50	0.19	14.3	53	12.8	0.52	9.6	10.7	170	1.0
13.4	0.31	0.03	0.36	0.08	12.6	47	9.0	0.24	7.6	4.6	135	0.6
Vegetable Products												
7.7	0.61	0.19	3.25	0.82	3.6	22	23.0	1.3	66.0	14.0	239	1.9
8.7	0.76	0.30	3.66	0.93	4.7	26	27.0	1.8	76.0	16.0	260	3.9
5.9	0.50	0.09	2.68	0.66	1.6	15	17.0	0.9	56.0	11.0	217	1.6
8.0	0.65	0.20	3.32	0.83	3.9	24	23.0	1.2	69.0	14.1	259	1.9
8.7	0.75	0.54	3.93	1.54	4.7	27	28.0	2.1	73.0	16.1	279	3.9
7.3	0.54	0.09	2.70	0.67	3.1	21	18.0	0.5	60.0	8.8	240	1.2
8.9	0.49	0.13	1.77	1.12	6.5	29	36.0	0.8	32.0	21.0	180	0.9
10.5	0.66	0.21	1.97	1.63	8.2	35	43.0	1.0	38.0	24.0	242	1.6
7.9	0.35	0.07	1.63	0.98	5.7	25	29.0	0.5	29.0	19.0	133	0.4
8.3	0.46	0.11	1.69	0.96	6.1	27	42.0	0.8	33.0	21.0	167	1.2
9.6	0.78	0.19	2.04	1.42	7.4	31	57.0	1.4	42.0	26.0	323	3.0
7.4	0.31	0.05	1.42	0.79	5.2	24	37.0	0.3	25.0	18.0	122	0.2
8.4	0.47	0.13	1.69	1.11	6.1	27	40.0	0.9	32.0	19.0	153	1.8
9.7	0.72	0.25	2.05	1.55	7.2	31	45.0	1.4	43.0	23.0	220	8.0
6.6	0.35	0.05	1.28	0.74	4.8	22	30.0	0.5	24.0	15.0	97	0.3
32.2	1.41	0.20	7.61	1.91	22.9	121	38.0	2.8	131.0	50.0	438	147.0
34.9	2.03	0.36	8.94	2.14	25.1	131	66.0	4.1	145.0	63.0	515	390.0
29.5	1.02	0.08	6.37	1.70	20.4	110	28.0	2.0	108.0	43.0	326	25.0
27.3	1.46	0.13	6.23	1.69	19.5	102	23.0	1.9	96.0	46.0	490	129.4[a]
29.2	1.90	0.28	7.31	1.94	21.2	109	33.0	3.7	125.0	56.0	559	345.0
23.8	1.15	0.04	4.92	1.31	16.2	88	13.0	1.2	84.0	39.0	418	0.7
9.4	0.73	0.27	3.24	1.12	5.2	29	58.0	0.7	59.0	22.0	241	16.8
12.5	0.93	0.44	4.41	1.34	6.9	39	76.0	1.4	85.0	34.0	350	26.1
7.6	0.60	0.11	2.45	0.97	3.8	23	48.0	0.2	45.0	10.0	141	6.2

Table I. Vitamin, Proximate, and Mineral

(Average value, followed

	Sets Tested	Ascorbic Acid			Vitamins, Mg./100 Grams						
		Reduced	Dehydro	Total	β-Carotene	Folic acid	Niacin	Pantothenic acid	Riboflavin	Thiamine	Vitamin B_6
Broccoli											30 Frozen Vegetable
Spears	33	75.4	2.9	78.3	1.13	0.038	0.56	0.468	0.13	0.07	0.171
		101.5	13.9	103.4	3.28	0.072	0.70	0.635	0.20	0.11	0.306
		58.6	0.1	60.0	0.74	0.013	0.35	0.240	0.09	0.04	0.065
Brussels sprouts	28	82.3	4.9	87.2	0.34	0.048	0.60	0.378	0.11	0.10	0.162
		98.4	19.9	105.1	0.47	0.086	0.74	0.483	0.15	0.13	0.236
		68.4	0.1	72.5	0.18	0.014	0.45	0.276	0.09	0.07	0.112
Cauliflower	23	51.9	4.0	55.9	0.02	0.020	0.48	0.467	0.06	0.06	0.177
		72.8	14.5	81.7	0.04	0.043	0.70	0.690	0.08	0.08	0.320
		39.1	0.1	43.8	0.01	0.010	0.25	0.213	0.04	0.04	0.091
Collard greens	4	65.0	3.1	68.1	4.09	0.072	0.69	0.425	0.16	0.07	0.183
		83.9	4.9	86.3	5.20	0.143	1.00	0.623	0.20	0.10	0.208
		49.9	0.9	54.7	3.58	0.037	0.42	0.264	0.12	0.05	0.140
Corn, cut	35	7.2	1.1	8.3	0.05	0.021	1.61	0.360	0.07	0.11	0.222
		9.9	3.4	10.8	0.09	0.084	2.05	0.712	0.09	0.17	0.350
		2.2	<0.1	5.5	0.02	0.007	1.29	0.156	0.05	0.04	0.144
Corn-on-cob (edible portion)	19	9.3	0.6	9.9	0.06	0.017	1.89	0.414	0.09	0.17	0.285
		12.8	2.3	12.9	0.12	0.036	2.60	0.564	0.11	0.21	0.665
		3.2	0.1	5.5	0.04	0.006	1.12	0.183	0.07	0.14	0.187
Kale, leaf and chopped	8	62.6	1.8	64.4	4.89	0.073	0.77	0.376	0.18	0.08	0.185
		80.0	9.9	82.1	5.48	0.097	1.00	0.603	0.22	0.09	0.276
		38.3	0.1	38.5	4.00	0.040	0.60	0.192	0.12	0.05	0.104
Mixed vegetables	28	8.3	0.9	9.2	3.00	0.016	1.16	0.276	0.07	0.13	0.122
		11.9	3.8	12.5	4.60	0.023	1.50	0.490	0.09	0.17	0.204
		1.9	<0.1	4.9	1.90	0.009	0.86	0.160	0.04	0.08	0.088
Mustard greens, leaf and chopped	2	32.1	1.8	33.9	3.59	0.036	0.42	0.164	0.12	0.04	0.133
		35.4	2.4	37.9	3.68	0.043	0.49	0.215	0.15	0.04	0.160
		28.8	1.2	29.9	3.50	0.029	0.36	0.113	0.09	0.04	0.106
Okra, cut and spears	9	11.2	4.6	15.8	0.29	0.025	1.03	0.221	0.21	0.17	0.045
		19.5	10.0	22.5	0.50	0.042	1.23	0.274	0.25	0.22	0.053
		8.3	0.7	4.5	0.16	0.011	0.70	0.131	0.10	0.08	0.029
Peas and Carrots	22	8.9	1.1	10.0	5.56	0.015	1.34	0.253	0.07	0.20	0.095
		12.3	2.6	12.9	7.40	0.030	1.70	0.359	0.10	0.25	0.156
		2.9	<0.1	3.8	3.10	0.006	1.05	0.170	0.04	0.14	0.045
Peas											
Black-eyed	8	9.7	3.1	12.8	0.10	0.038	1.38	0.398	0.12	0.45	0.118
		14.1	7.2	16.4	0.13	0.057	1.65	0.563	0.15	0.66	0.171
		6.3	0.4	9.1	0.03	0.028	1.24	0.329	0.07	0.33	0.074
Green sweet	69	17.1	1.6	18.7	0.41	0.020	2.05	0.277	0.10	0.32	0.150
		23.0	6.5	23.3	0.51	0.046	2.56	0.680	0.14	0.42	0.306
		10.4	0.0	11.9	0.29	0.008	1.30	0.143	0.06	0.24	0.080
Potatoes											
Diced hash brown	4	7.5	1.6	9.1	Trace	0.008	0.63	0.323	0.01	0.07	0.087
		10.3	2.7	11.0	<0.01	0.013	0.79	0.673	0.01	0.09	0.122
		3.2	0.6	4.6	<0.01	0.005	0.45	0.123	0.01	0.04	0.062
French fried	16	17.4	2.6	20.0	0.02	0.008	2.13	0.533	0.02	0.14	0.154
		24.9	5.2	26.5	0.04	0.014	3.00	0.785	0.03	0.16	0.233
		11.7	0.9	13.4	0.01	0.005	1.45	0.390	0.01	0.11	0.085
Mashed	3	4.9	1.4	6.3	0.02	0.007	0.82	0.240	0.03	0.07	0.091
		7.4	2.6	10.0	0.03	0.008	0.94	0.284	0.04	0.08	0.139
		2.4	0.5	3.5	0.01	0.004	0.75	0.208	0.02	0.06	0.064
Spinach											
Chopped	26	25.5	3.8	29.3	4.72	0.059	0.48	0.113	0.16	0.09	0.148
		40.8	9.9	44.9	7.35	0.107	0.66	0.203	0.22	0.14	0.246
		4.9	0.2	7.6	3.52	0.021	0.30	0.061	0.08	0.05	0.042
Leaf	28	31.9	3.2	35.1	4.85	0.079	0.51	0.110	0.16	0.10	0.176
		46.4	8.1	49.4	7.35	0.129	0.75	0.188	0.20	0.15	0.245
		10.4	0.2	13.0	3.76	0.053	0.35	0.060	0.08	0.05	0.076
Squash											
Winter	12	7.6	2.1	9.7	2.35	0.012	0.49	0.282	0.07	0.03	0.091
		11.4	4.8	14.7	4.30	0.017	0.70	0.398	0.10	0.04	0.118
		2.8	0.3	4.7	1.06	0.008	0.33	0.211	0.04	0.02	0.057
Yellow crookneck	3	4.8	4.9	9.7	0.09	0.016	0.44	0.173	0.04	0.07	0.063
		10.9	6.9	12.4	0.10	0.023	0.60	0.195	0.06	0.08	0.088
		1.2	1.6	7.4	0.07	0.011	0.26	0.136	0.02	0.06	0.039
Succotash	16	7.5	1.7	9.2	0.09	0.012	1.47	0.443	0.06	0.11	0.181
		11.6	5.6	11.9	0.16	0.026	1.87	0.604	0.08	0.13	0.254
		0.7	0.0	6.3	0.06	0.005	1.29	0.248	0.05	0.09	0.131
Turnip greens, leaf and chopped	10	31.6	2.1	33.7	4.13	0.038	0.54	0.140	0.11	0.06	0.098
		42.3	7.7	46.3	5.40	0.074	0.75	0.224	0.20	0.10	0.144
		19.1	0.0	20.2	3.52	0.019	0.30	0.075	0.06	0.03	0.052

[a] See Table II for effect of method of processing.

Composition of Frozen Foods *(Continued)*

by maximum and minimum)

Proximate Composition							Minerals, Mg./100 Grams					
				Carbohydrate, %								
Solids, %	Ash, %	Ether extract, %	Protein, %	Crude fiber	Total by difference	Calories/100 g., Atwater system	Calcium	Total iron	Phosphorus	Magnesium	Potassium	Sodium
Products (*Continued*)												
9.3	0.70	0.22	3.34	1.08	5.0	28	43.0	0.7	60.0	20.0	244	13.0
10.6	1.01	0.35	4.12	1.52	6.5	33	55.0	1.3	73.0	29.0	318	25.0
8.4	0.39	0.09	2.90	0.84	3.5	25	37.0	0.3	42.0	12.0	170	6.2
11.6	0.84	0.17	3.34	1.23	7.3	36	22.0	0.9	62.0	21.0	328	16.0
13.0	1.24	0.25	3.63	1.73	8.5	41	26.0	2.1	76.0	28.0	368	22.0
10.2	0.70	0.03	2.97	0.97	6.2	31	15.0	0.5	55.0	17.0	213	11.0
7.1	0.60	0.15	2.05	0.82	4.3	22	19.0	0.6	42.0	13.1	225	10.8
9.2	0.80	0.27	2.53	1.19	5.6	28	23.0	1.0	57.0	16.5	283	19.1
5.6	0.36	0.04	1.75	0.61	2.9	16	13.0	0.2	36.0	9.0	194	3.8
10.3	1.02	0.39	3.08	1.02	5.8	31	191.0	1.1	53.0	35.0	259	17.5
12.4	1.33	0.56	3.98	1.06	8.0	39	256.0	1.5	64.0	53.0	326	23.3
8.0	0.84	0.28	2.50	0.95	4.1	24	146.0	0.7	43.0	27.0	208	7.8
23.8	0.48	0.52	3.14	0.54	19.6	82	3.2	0.8	78.0	22.0	202	1.4
28.2	0.62	0.85	4.31	0.79	23.1	97	8.5	1.9	118.0	30.0	230	5.8
16.2	0.23	0.20	2.63	0.42	14.9	56	0.5	0.2	61.0	14.0	164	0.1
27.9	0.68	1.00	3.59	0.67	22.6	98	2.9	0.8	102.0	34.0	254	0.7
30.4	0.80	1.31	4.34	0.85	24.9	108	3.9	1.2	122.0	42.0	281	2.2
24.7	0.58	0.61	2.30	0.54	20.0	85	1.6	0.6	82.0	21.0	235	0.2
10.0	0.85	0.51	3.24	0.91	5.4	31	134.0	1.1	50.0	31.0	241	26.4
12.2	0.97	0.62	4.10	1.02	7.0	39	174.0	2.0	72.0	41.0	352	53.5
8.3	0.75	0.38	2.38	0.77	4.3	25	89.0	0.6	33.0	25.0	170	7.7
17.9	0.65	0.34	3.31	1.24	13.6	65	26.0	1.4	66.0	24.0	208	59.0
21.4	0.88	0.54	4.36	1.70	16.3	77	39.0	2.6	85.0	32.0	288	108.0
15.4	0.39	0.18	2.63	0.95	12.0	55	18.0	0.7	53.0	13.0	137	24.0
6.5	0.60	0.37	2.28	0.96	3.3	20	115.0	1.6	45.0	23.0	196	12.0
6.6	0.62	0.40	2.38	1.02	3.3	20	115.0	1.8	49.0	29.0	216	15.0
6.4	0.57	0.33	2.18	0.90	3.3	20	114.0	1.3	42.0	17.0	176	10.0
12.1	0.68	0.07	2.26	0.99	9.1	38	94.0	0.6	51.0	53.0	219	1.8
14.2	0.79	0.11	2.62	1.20	11.0	46	110.0	0.9	56.0	62.0	249	2.2
10.1	0.56	0.01	1.94	0.90	7.2	32	78.0	0.3	44.0	47.0	194	1.2
14.6	0.63	0.27	3.29	1.51	10.4	55	26.0	1.2	59.0	19.0	171	92.0
18.4	0.91	0.44	3.89	1.86	13.6	69	40.0	2.0	76.0	25.0	220	144.0
12.1	0.40	0.14	2.73	1.25	8.7	45	21.0	0.6	52.0	13.0	123	47.0
34.2	1.23	0.39	9.02	1.52	23.6	130	28.0	3.1	179.0	55.0	387	49.8[a]
37.6	1.56	0.49	10.70	1.79	26.0	143	36.0	4.6	204.0	63.0	438	200.0
30.7	0.92	0.27	7.98	1.21	21.2	118	24.0	2.2	154.0	43.0	330	0.8
19.3	0.75	0.34	5.39	1.87	12.8	74	20.0	2.0	90.0	24.0	150	129.0
22.7	1.22	0.59	7.00	2.53	14.8	88	40.0	3.6	110.0	30.0	190	305.0
17.2	0.38	0.17	4.61	1.09	11.1	66	13.0	1.1	76.0	17.0	98	45.0
19.0	0.41	0.04	1.21	0.41	17.3	74	9.8	0.7	30.0	18.0	170	8.3
21.6	0.66	0.06	1.56	0.47	20.0	84	10.3	0.8	38.0	27.0	292	13.4
17.2	0.21	0.02	0.96	0.35	15.8	67	8.9	0.2	26.0	10.0	96	3.0
36.5	1.07	6.52	2.83	0.58	25.9	170	6.9	1.4	67.0	25.0	506	3.1
40.3	1.43	8.41	3.50	0.70	30.7	194	10.1	1.8	107.0	35.0	654	10.0
32.3	0.75	4.73	2.32	0.32	19.9	154	3.9	0.8	44.0	20.0	353	0.7
19.6	0.70	0.10	1.68	0.39	17.1	75	16.0	0.7	39.0	12.0	229	79.0
20.4	0.88	0.15	1.83	0.40	18.4	79	17.0	1.4	46.0	13.0	283	93.0
18.3	0.54	0.03	1.47	0.37	15.7	70	14.0	0.0	35.0	11.0	147	63.0
8.4	1.18	0.33	3.08	0.83	3.8	24	113.0	2.1	45.0	64.0	354	57.3
10.5	1.52	0.53	4.82	1.00	4.9	30	166.0	3.5	63.0	84.0	563	118.0
5.9	0.90	0.22	2.30	0.63	1.9	15	80.0	0.7	23.0	36.0	179	9.1
8.7	1.18	0.27	3.03	0.77	4.2	25	105.0	2.5	45.0	65.0	385	53.0
11.8	1.50	0.42	4.31	0.90	6.6	35	167.0	4.5	61.0	91.0	538	139.0
6.5	0.88	0.13	2.35	0.65	2.9	18	60.0	0.8	27.0	18.0	190	5.2
11.2	0.50	0.32	1.21	1.24	9.2	38	25.0	1.0	32.0	17.0	207	0.5
12.8	0.68	0.60	1.53	1.52	10.7	44	40.0	2.4	41.0	24.0	259	0.8
8.5	0.34	0.12	0.99	0.93	6.5	28	17.0	0.5	26.0	14.0	160	0.3
6.6	0.40	0.08	1.45	0.56	4.7	21	14.0	0.7	32.0	16.0	167	3.0
7.0	0.48	0.10	1.67	0.63	4.9	22	17.0	0.7	37.0	19.0	214	7.5
6.1	0.32	0.07	1.16	0.53	4.5	19	11.0	0.5	28.0	12.0	126	0.5
27.0	0.79	0.39	4.32	0.92	21.5	96	14.1	1.1	89.0	31.0	273	44.7[a]
29.2	1.05	0.56	5.55	1.13	22.9	108	24.2	1.9	107.0	43.0	331	155.0
24.5	0.61	0.16	3.69	0.76	19.8	87	6.0	0.5	75.0	26.0	233	0.7
7.7	0.77	0.34	2.60	1.03	3.9	23	131.0	1.7	41.0	26.0	188	22.6
9.3	0.95	0.46	3.48	1.26	5.7	28	165.0	3.5	59.0	35.0	258	43.5
5.8	0.57	0.27	2.04	0.78	2.4	17	105.0	0.9	30.0	20.0	134	4.6

ethyl alcohol and Skellysolve B, was necessary for apricots and peaches.

Samples digested with chick pancreas enzyme were employed in determining folic acid by a microbiological method using *S. faecalis* (*2*). Niacin and riboflavin assays were run by microbiological procedures (*14*, *15*). The thiochrome method (*4*) was used for thiamine assays. Pantothenic acid was run by a microbiological method (*21*), and the samples were digested with intestinal phosphatase plus either pigeon liver or hog kidney enzyme. Vitamin B_6 was determined by the method of Atkins and others (*5*) with two modifications: The medium was supplemented with nicotinic acid (*9*) and samples were autoclaved at 15 pounds pressure for 2 hours in 0.06*N* sulfuric acid (*16*).

Moisture, ash, fat, protein, and crude fiber analyses were performed by AOAC procedures (*1*). The values for fat represent ether extracts. Calories were calculated on the basis of specific factors of the Atwater system (*12*) applied to fat, protein, and total carbohydrate (carbohydrate by difference).

Calcium was determined by a titrimetric method (*10*) after dry ashing of the samples. Sodium and potassium were determined by flame photometry (*6*) after the samples had been dry-ashed in the presence of magnesium nitrate. A colorimetric method based on that of Harvey, Komarmy, and Wyatt (*8*) was employed for determination of magnesium. Colorimetric methods were used for phosphorus (*7*) and total iron (*19*). The method for iron was modified by omitting citrate, substituting 2,2′-dipyridine for *o*-phenanthroline, and substituting thioglycolic acid for hydroquinone.

Results and Discussion

The results are presented in Table I. The figures for each nutritional component per 100 grams of product given in Table I represent slightly more than the amounts present in a serving consisting of one third of a 10-ounce package of fruit or vegetable, or 3.2 fluid ounces of juices prepared from concentrate according to label directions. Unless specified to the contrary, the discussion deals with average values for each product.

Table II. Effect of Method of Processing on Ascorbic Acid and Sodium Content

Method of Processing		Total Ascorbic Acid in Frozen Fruits, Mg./100 Grams: Apricots	Peaches
No ascorbic acid added	Average	8.6	11.2
	Maximum	12.3	11.2
	Minimum	6.1	11.2
	Sets tested	4	1
Ascorbic acid added	Average	65.3	41.3
	Maximum	100.3	76.1
	Minimum	30.3	24.3
	Sets tested	2	19

		Sodium in Frozen Fruit, Juice, and Vegetable Products, Mg./100 Grams: Apples, sliced	Fordhook Lima beans	Orange[a] juice	Peas, black-eyed	Succotash
No salt used	Average	14.0	7.1	0.4	1.4	0.7
	Maximum	28.0	15.9	0.6	1.8	0.7
	Minimum	2.2	0.7	0.2	0.8	0.7
	Sets tested	5	12	44	6	2
Salt used	Average	196.0	171.0	3.6	195.0	51.0
	Maximum	200.0	345.0	4.5	200.0	155.0
	Minimum	191.0	28.0	2.8	190.0	13.0
	Sets tested	2	35	2	2	14

[a] Two sets out of 46 orange juice samples were abnormally high in sodium and were treated separately in this table to provide a more realistic value.

Frozen Fruits. All the fruit products tested contained appreciable amounts of ascorbic acid in relation to the 75-mg. recommended daily dietary allowance of the National Research Council (*13*) for men. Strawberries, and those peaches and apricots containing added ascorbic acid, had the highest levels (41 to 65 mg. per 100 grams). One hundred grams of frozen apricots furnish 1 mg. of β-carotene or about one fourth of man's daily allowance of vitamin A. Frozen cherries are also a good source of this vitamin.

In general, relatively small fractions of the dietary requirements for folic acid, riboflavin, and thiamine are supplied by a serving of frozen fruit. Pineapple chunks contained the greatest amount of thiamine, with an average of 0.1 mg. per 100 grams. The daily thiamine allowance for men is 1.3 to 1.6 mg. per day. The amounts of niacin, pantothenic acid, and vitamin B_6 in frozen fruits provide a moderate contribution of these vitamins to the diet.

The carbohydrate and calorie values computed from proximate composition are of particular interest. All the fruits were sweetened, unless otherwise indicated. The average percentage of sugar added to the samples at the time of packing was as follows: pineapple chunks, 10; boysenberries, 12; apples, 14; peaches and rhubarb, 16; apricots and whole strawberries, 17; cultivated blueberries, R.S.P. cherries, and red raspberries, 18; and sliced strawberries, 20. Unsweetened fruits have about one half the carbohydrate content and calorie values of the customary sweetened products. Unsweetened fruits provide the possibility of greater variety in low-carbohydrate and low-calorie diets.

On the basis of average sodium values ranging from 0.5 mg. per 100 grams of blueberries to 3.9 mg. per 100 grams of apricots, all the fruits except apples may be considered low-sodium foods. The use of certain sodium salts in processing some of the apples increased the average sodium content of that product (Table II). The calcium, magnesium, phosphorus, and iron contents indicate moderate contributions of these elements to the diet.

In Table II it will be noted that the addition of ascorbic acid for the retention of color in apricots and peaches is reflected in a markedly higher ascorbic acid content (in commercial practice about 50 mg. of ascorbic acid are added per 100 grams of peaches or apricots).

Although rhubarb is classified horticulturally as a vegetable, it is included with the fruits in this paper because it is commonly considered a fruit in industry practice and usage by homemakers.

Frozen Juices. Except for lemon juice, which is ordinarily frozen without concentration, assays on fruit juices were

performed on concentrates. For convenience and uniformity, the values given in Table I were calculated for juice prepared according to directions given on the label. The juices were unsweetened, except for grape and lemonade. The average amount of sugar added to the grape concentrate during manufacture was 18 grams per 100 grams of concentrate. The amount of sugar used in manufacturing lemonade concentrate ranged from 43 to 49 grams per 100 grams of concentrate.

Juices containing the highest levels of ascorbic acid included lemon, orange, orange-grapefruit blend, and grapefruit. The average value of 47.2 mg. for 100 grams of orange juice is more than one half of the National Research Council's recommended daily dietary allowance for adult men. As stated by Krehl and Cowgill (*11*), ". . . . it is clear that citrus fruits remain as one of the most practical sources of ascorbic acid in the nutritional economy."

The average sodium content of juices ranges from 0.3 to 1.3 mg. per 100 grams. Orange juice is particularly low in sodium.

Grapefruit juice, orange-grapefruit blend, lemonade, and orange juice are grouped together at about 41 calories per 100 grams.

Frozen Vegetables. High ascorbic acid values, ranging from 56 to 87 mg. per 100 grams, were found in Brussels sprouts, cauliflower, broccoli (chopped and spears), collard greens, and kale. Vegetables containing about one third as much ascorbic acid (16 to 35 mg. per 100 grams) included asparagus (cuts and tips, and spears), Lima beans (baby and Fordhook), mustard greens, okra, peas, French fried potatoes, spinach (chopped, and leaf), and turnip greens.

Products containing between 2.0 and 6.0 mg. of β-carotene per 100 grams were broccoli (chopped) collard greens, kale, mixed vegetables, mustard greens, peas and carrots, spinach (chopped, and leaf), and turnip greens.

As one might expect, the green leafy vegetables contained the most folic acid. Asparagus (cuts and tips, and spears), broccoli (chopped and spears), Brussels sprouts, collard greens, kale, mustard greens, peas (black-eyed), spinach (chopped and leaf), and turnip greens had average contents between 0.04 and 0.08 mg. of folic acid per 100 grams. The National Research Council has not set an absolute allowance for this vitamin but suggests that somewhat less than 1 mg. per day would probably cover nutritional needs.

All products had niacin values within a range of 0.42 and 2.1 mg. per 100 grams (daily allowance 13 to 16 mg.). The range of pantothenic acid values was from 0.11 to 0.53 mg. per 100 grams (no allowance established). Vegetables with more than 0.13 mg. of riboflavin per 100 grams (daily allowance 1.6 mg.) were asparagus (cuts and tips, and spears), broccoli (chopped and spears), collard greens, kale, okra, and spinach (chopped and leaf).

Asparagus (cuts and tips, and spears), corn (cob), okra, and peas and carrots contained from 0.16 to 0.20 mg. of thiamine per 100 grams; peas contained 0.32 mg. per 100 grams; and black-eyed peas contained 0.45 mg. per 100 grams. Half of the vegetable products contained more than 0.15 mg. of vitamin B_6 per 100 grams. Corn (cut and cob) contained over 0.20 mg. per 100 grams. The allowance for vitamin B_6 has not been set, but 1 to 2 mg. per day is suggested as a good intake.

Black-eyed peas had an average of 9% protein, while succotash, Lima beans (baby and Fordhook), and peas had 4 to 8% protein. Eighteen of the 30 vegetable products contained from 2 to 4% protein. All vegetables had less than 2.0% crude fiber and less than 1% fat, except for potatoes (French fried), which had an average of 6.5% fat. Frozen green leafy vegetables, asparagus (cuts and tips, and spears), green and wax beans, cauliflower, broccoli (chopped and spears), and squash (yellow crookneck) furnish about 25 calories per 100 grams.

Green leafy vegetables were highest in calcium, while asparagus (cuts and tips, and spears), broccoli (chopped and spears), Brussels sprouts, legumes, corn (cut and cob), and mixed items led in phosphorus content. Products which were very low in sodium and can be considered useful in formulating low-sodium diets include: asparagus (cuts and tips, and spears), beans (green and wax), corn (cut and cob), okra, French fried potatoes, and squash (yellow crookneck and winter). Black-eyed peas and Fordhook Lima beans processed without quality grading in brine are also included in this group. Sodium values of peas and Lima beans are increased by quality grading in sodium chloride solution. Therefore, mixed items, containing such peas and/or Lima beans, also have higher sodium values. Sodium chloride is added in the processing of frozen mashed potatoes as a seasoning agent.

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