Vitamin C and Mineral Contents in Selected Leafy and non-Leafy Vegetables of Bangladesh

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Abstract

Seventeen green leafy vegetables (GLVs) and eighteen non-leafy vegetables (NLVs) which are popularly consumed were investigated for their vitamin C and content of copper, zinc, iron, calcium and magnesium. Vitamin C was estimated by spectrophotometric method and mineral contents were determined by Atomic absorption flame spectrophotometric method. Result showed that ascorbic acid in GLVs, content ranged from 1.34±0.37mg% (Water cress) to 59.60±1.32 (Red amaranth) and in NLVs it was between 5.68±0.51mg% (Ridge gourd) and 80.07±0.89mg% (Bitter gourd). Both the GLVs and NLVs are found to be rich in minerals. Of these vegetables, Peas, Turnip, Ridge gourd are found to be a potential source of copper, zinc, iron, calcium and magnesium. It is, therefore revealed that these vegetables could be a very good source of micronutrient supplement.

Introduction

Micronutrient deficiency is a public health problem in most of the developing countries[1]. In spite of endowing with plenty of green (pro-vitamin A source) around and almost everywhere, vitamin A deficiency has been identified to be a major public health problem in Bangladesh. The nutrient composition of all the available and newly introduced green-yellow vegetables is not available. The values available are already forty years back and the analysis was done using the traditional methods[3]. With the discovery of modern machines and their high level of accuracy, there is a need to update the existing food tables and to find values for the newly introduced food crops, specially, the vegetables. Therefore, in an effort to update the food composition table and to fill in the data gap, we, in the present study, have investigated seventeen green leafy vegetables (GLVs) and twenty non-leafy green vegetables (NLVs) for their ascorbic acid, and mineral contents.

Material and Methods

Sample collection and processing. The vegetables were procured from farmer's fields and the major local wholesale markets where vegetables from different parts of the country are brought for sale. The samples collected from market were first cleaned with tape water to remove dust and other soil contamination, and then washed with

Bangladesh Journal of Nutrition. Vol 17 December 2004. Institute of Nutrition and Food Science, University of Dhaka-1000, Bangladesh

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deionized water. Samples were then wiped with paper towel, cut into small pieces and mixed uniformly, and weighed.

Analysis of ascorbic acid: Ascorbic acid was estimated by spectrophotometer using modified AOAC official method[4]. For estimation of ascorbic acid, a specific amount of sample (3g) was homogenized in a mortar with a pastle using clean sand and 10ml of 5% metaphosphoric acid (in 10% acetic acid). The mixer was filtered through a sintered glass filter by suction pump. The filtrate was then treated with norit. The norit treated vegetable extract (in metaphosphoric acid) was treated with 2,4-dintrophylhydrazine solution (2% in 9N sulphuric acid). It was heated at 37°C for 3hr. It was then treated with sulphuric acid (85%) in ice-bath, and finally read in a spectrophotometer (UV-1201, UV-VIS, Shimadzu, Kyoto, Japan) at 520nm.

Analysis of Zinc, Copper and Iron[5]. For mineral analysis, accurately weighed sample was made dry in an oven at 80°C for overnight. The dried sample was made powdered with mortar and pastle. The powdered sample was acid digested using an acid mixture (H_2SO_4:$HClO_4$:HNO_3=0.5:1:0.5) in block heater to make clear solution. It was then diluted with deionized water to make a specific volume. Concentrations of copper, zinc and iron were then determined by an atomic absorption flamme emission spectrophotometer (AA-6200 Series, Shimadzu Corporation, Kyoto, Japan) using standard copper, zinc and iron (Sigma Chemicals Co. USA). Absorbance of copper, zinc and iron were read at 324.8nm, 213.9nm and 248.3nm respectively. To verify the assay accuracy and quality, the standard mineral preparations were run for every 10 test samples. A software package (AA-6200, ver 1.1, Shimadzu Corporation, Kyoto, Japan) was used to calculate the minerals concentrations.

Results

Moisture content in GLVs ranged from 75g% to 92g%[6]. In GLVs, ascorbic acid content ranged from 1.34±0.37mg% (Water cress) to 59.60±1.32 (Red amaranth) and in NLVs it was between 5.68±0.51mg% (Ridge gourd) and 80.07±0.89mg% (Bitter gourd) per 100g edible portion (table1).

The green leafy vegetables contained a rich amount of minerals. All most all of the GLVs were found to be a very potential source of iron ranging from 328.9±70 µg% (cabbage) to 5718.5±1500 µg% (Red amaranth). Pea, Green arun, Bottle guard also found to contained considerable amount of copper (191.3±30µg%; 158.7±7µg%; 127.2±10µg% respectively) and zinc (820.5±150µg%; 720.6±100µg%; 448.4±50µg%; respectively). Zinc content was also found rich in Red amaranth (1407.4±190µg%), Thankuni (1253.1±270µg%) and Spinach (664.1±50µg%) (table 2). Red amaranth. Thankuni and Spinach were also found to be a good source of magnesium. But their calcium content are not significant as in NLVs.

Table 1: Ascorbic acid content (mean±sd mg%) in non-leafy vegetables (NLVs) and green leafy vegetables (GLVs) per 100g edible portion

NLVs	Ascorbic acid	GLVs	Ascorbic acid
Bean (Shim)	18.87±1.0	Spinach/Palong shak	19.92±0.86
Bitter gourd (Korola)	80.07±0.89	Red amaranth Lal shak	59.60±1.32
Brinjal black var. (Bagun)	6.03±0.76	Bottle gourd/Lau shak	30.83±0.21
Brinjal white var.(Bagun)	6.88±0.15	Water bind weed/Kolmee	nd
Cabbage (Badhacopi)	25.79±0.24	Green arum/Shobus kachu	36.13±4.69
Cauliflower (Fulcopi)	35.11±0.96	Radish Mula shak	15.61±0.71
Cucumber (Shasa)	11.98±0.52	Cabbage Badha kopi	21.16±0.35
Folwal potol (Potol)	28.43±0.20	Mustard/Sharisha shak	24.40±0.97
Okra (Darash)	39.97±0.98	Water cress/Helencha shak	1.34±0.37
Papaya (Papa)	18.23±0.01	Coriander/Dhane pata	51.49±4.95
Peas (Motorshoti)	10.29±0.23	Mint/Pudina pata	15.90±0.56
Potato (Lolit Aloo)	32.56±2.22	Thankuni/Thankuni pata	15.90±0.56
Potato sweet (Misti Aloo red)	35.12±0.26	Lambs quarter/Bathua shak	7.61±0.32
Pumkin (Misti Kumra)	12.50±1.34	Lettuce/Lettuce pata	13.7±1.06
Radish (Mula)	25.77±0.82	Pea/Motor shak	17..9±0.22
Ride gourd (Jhinga)	5.68±0.51	Fnugreek leaves/Methi shak	nd
Snake gourd (Chichinga)	29.92±1.06	Gram leaves/ Chola shak	9.19±0.43
Tomato green var.	29.80±0.15		
Tomato red var.	9.92±0.40		
Turnip (Shalgom)	44.32±1.41		

The non-leafy vegetables were found to be rich in minerals. But there was a wide variation in their mineral content. Radish contained remarkably high amount of copper (1991.43±123μg%). Jhinga (770.80±90μg%), Peas (506.70±30μg%), Bean (272.00±34μg%), Korola (204.70±17μg%), Pumkin (213.80±39μg%) also contained considerable amount of minerals (table 3). Concentration of zinc was found to be rich in Peas (345.9.0±158μg%), Turnip (1200.6±149μg%), Pumkin (941.30±136), Cauliflower (579.32±74.21μg%), Cabbage (715.69±70.2μg%), Jhinga (423.91±49.

4μg%). The later three were also good source of iron, calcium and magnesium. It was also noted that potato contained a rich amount of zinc and iron.

Table 2: Mineral (Cu, Zn, Fe, Ca, Mg) contents in non-leafy vegetables per 100g edible portion

non-Leafy Vegetables	Copper	Zinc	Iron	Calcium	Magnesium
	μg% (mean±sd)			mg% (mean±sd)	
Bean (Shim)	272.00±34	480.30±15	238.90±16	16.22±0.30	24.75±0.68
Bitter gourd (Korola)	204.70±17	347.30±51	1537.4±257	17.99±6.97	48.18±1.41
Brinjal black var. (Bagun)	109.40±07	188.40±24	371.30±74	12.93±1.35	31.63±0.65
Brinjal white var.(Bagun)	94.50±05	251.20±23	144.40±23	6.23±0.54	17.47±0.41
Cabbage (Badhacopi)	12.50±07	715.69±70.2	124.9±10	5.04±0.05	5.16±0.07
Cauliflower (Fulcopi)	88.90±11	579.32±74.2	1523.6±65	22.47±0.72	22.18±1.47
Cucumber (Shasa)	24.30±09	172.20±28	56.80±01	5.41±0.37	5.43±0.17
Papaya (Papa)	11.50±01	176.80±12	167.50±03	6.05±0.30	9.02±0.47
Peas (Motorshoti)	506.70±30	3459.0±158	2376.4±421	46.23±2.54	61.25±1.20
Potato vegetable (Aloo)	200.4±07	424.30±81	377.5±136	3.93±0.29	18.24±1.73
Potato sweet (Misti aloo)	164.6±27	509.20±28	1371.6±250	7.54±0.40	12.68±0.29
Pumkin (Misti Kumra)	213.80±39	941.30±136	4139.0±394	59.56±5.65	57.29±0.43
Radish (Mula)	1991.43±123	548.80±22	59.50±04	17.99±6.97	48.18±1.41
Ridge gourd (Jhinga)	770.80±90	423.91±49.4	1675.3±365	90.64±1.13	88.44±1.35
Snake gourd (Chichinga)	55.20±02	228.70±04	338.20±03	13.43±0.44	6.38±0.11
Tomato green (unripe)	49.00±04	191.50±02	317.40±44	8.65±0.25	12.56±0.53
Tomato red (ripe)	35.30±05	321.10±17	389.30±61	6.27±0.27	10.08±0.33
Turnip (Shalgom)	136.30±201	1200.6±149	774.10±262	99.81±0.17	51.10±1.04

Table 3: Mineral contents in Green Leafy Vegetables (GLVs)

GLVs	Copper	Zinc	Iron	Calcium	Magnesium
	mg% (mean±sd)	µg% (mean±sd)		mg% (mean±sd)	
Spinach/Palong shak	60.80±5.0	664.10±50.0	1845.2±130.0	1.41±.0.15	30.06±1.87
Red amaranth/Lal shak	109.00±6.0	1407.40±190	5718.5±1500	1.50±0.02	67.59±2.51
Bottle gourd/Lau shak	127.20±10.0	448.40±50.0	2907.9±550.0	1.78±.0.46	41.39±7.37
Water bind weed/Kolmee	59.60±.3.0	253.5±20.0	1602.5±300.0	0.37±0.02	22.42±4.40
Green arum/Shobus kachu	158.70±7.0	720.60±100.0	3052.6±730.0	0.21±0.02	42.70±2.43
Radish/Mula shak	26.80±6.0	690.60±100.0	1040.0±120.0	0.70±0.05	26.26±1.38
Cabbage/Badha kopi	27.50±7.0	207.30±50.0	328.9±70.0	2.25±0.15	31.22±5.44
Mustard/Sharisha shak	103.00±50.0	371.70±100.0	1515.1±300.0	0.56±0.03	32.73±1.44
Water cress/Helencha	18.60±2.0	518.10±100.0	1899.3±410.0	0.39±0.01	26.68±1.77
Coriander/Dhane pata	72.40±20.0	253.80±20.0	757.1±130.0	0.68±0.01	39.21±5.58
Mint/Pudina pata	123.70±50.0	160.70±20.0	1736.2±360.0	1.72±0.07	42.27±1.79
Thankuni/Thankuni pata	84.20±3.0	1253.10±270	2765.8±580.0	0.72±0.01	61.84±3.63
Lambs quarter/Bathua	109.30±20.0	366.60±60.0	811.0±160.0	0.37±0.02	92.77±4.62
Lettuce/Lettuce pata	55.70±10.0	277.10±50.0	662.50±160.0	3.99±0.28	30.46±3.90
Pea/Motor shak	191.30±30.0	820.50±150.0	3369.60±900	5.57±0.15	73.69±9.78
Fnugreek leaves/Methi sha	96.50±7.0	344.10±60.0	2562.40±440	1.89±0.13	41.01±2.39
Gram leaves/ Chola shak	106.60±3.0	277.70±40.0	1366.80±180	4.90±0.270	26.99±4.50

Discussion

This study has identified some very rich vegetable sources of micronutrients. In addition to its role in addressing the widely prevalent multiple micronutrient deficiencies, these also have potential antioxidant activity. Presently the government and the NGOs are very active in addressing the micronutrient malnutrition through food based approach by promoting homestead horticulture and backyard gardening. Considering the micronutrient content of these studied vegetables, these vegetables can be incorporated in greater amount in the food system and can be popularized amongst the people for their production and consumption. The values derived from the study can be incorporated in our old food composition tables to update the table.

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