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Chemical Composition of Some Leafy Vegetables of Bangladesh

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Abstract

The chemical composition, such as water, ash, iron and total vitamin C content, of 28 green leafy vegetables were analyzed in this investigation. The water content of the leafy vegetables varied between 83.8 to 95.5 g/100 g fresh vegetable sample. The ash content of the samples varied between 8.0 to 22.6 g /100 g of dry vegetable powder. The iron content of the leafy vegetables varied from 11.8 to 78.2 mg/100 g of dry sample and the total vitamin C content varied from 191.5 to 21.6 mg/100 g of fresh sample. These findings conclusively suggest that the locally available leafy vegetables are good source of water, minerals, iron and vitamin C.

Keywords: Leafy vegetables, composition, water, ash, iron, total vitamin C, Bangladesh.

I. Introduction

Vegetables play a vital role in our daily food list and these are important sources of nutrients. People can survive on vegetables alone if they have nothing else to eat. This is specifically true for the poor people of the village of Bangladesh. The importance of vegetables is unlimited because the required elements which are essential for our body are obtained from vegetables. More specifically green leafy vegetables have the greatest impact on blood pH, offsetting the acidity caused by a number of unavoidable factors. In addition to the nutritional value and its possible effects of the blood pH, these vegetables can detoxify the unwanted metals and impurities of our body, found in modern highly processed diet. Leafy vegetables play a leading role among various kinds of food in dietary intake to keep our body fit and healthy. For this, its thorough investigation is necessary to find out the different nutritional aspects of the leafy vegetables, which are commonly consumed by the people of Bangladesh. Although investigations on the leafy vegetables have been carried out[1-2] more investigations are necessary using the modern techniques to explore their latent importance as nutritional aspects and medicinal role. With this end in view, this project was undertaken to carry out a thorough analysis of some indigenous leafy vegetables.

The present report deals with the nutritional status of lesser-known underutilized leafy vegetables grown in Bangladesh and hence to explore its importance as a diet for local people.

Table 1. English, local and Botanical names of the collected leafy vegetables of Bangladesh

Sl. No.	English Name	Local Name	Botanical Name	Family
1	Turnip leaves	Shalgom Pata	*Brassica rapa* L. var. *rapa*	Brassicaceae
2	Joseph's coat leaves	Lal Shak	*Amaranthus tricolor* L.	Amaranthaceae
3	Garden spinach leaves	Palong Shak	*Spinacia oleracea* L.	Amaranthaceae
4	Coriander leaves	Dhoney Pata	*Coriandrum sativum* L.	Apiaceae
5	Cauliflower leaves	Fulkopi Pata	*B. oleracea* L. var. *botrytis*	Brassicaceae
6	Radish leaves	Mula Pata	*Raphanus sativus* L.	Brassicaceae
7	Onion leaves	Pyaz Pata	*Allium cepa* L.	Amaryllidaceae
8	Bottle gourd leaves	Lau Shak	*Lagenaria siceraria* (Molina) Standl.	Cucurbitaceae
9	Sweet potato leaves	Mishti Alu Shak	*Ipomoea batatas* L.	Convolvualceae
10	Marsh Herb leaves	Helencha Shak	*Enhydra fluctuans* Lour.	Compositae
11	Water spinach leaves	Kalmi Shak	*Ipomoea aquatica* Forssk	Convolvulaceae
12	Amaranths leaves	Data Shak	*Amaranthus gangeticus* L.	Amaranthaceae
13	Jute leaves	Pat Shak	*Corchorus capsularis* L.	Malvaceae
14	Indian spinach leaves	Pui Shak	*Basella rubra* L.	Basellaceae
15	Mint leaves	Pudina Pata	*Mentha viridis* L.	Lamiaceae
16	Garden lettuce leaves	Latus Pata	*Lactuca sativa* L.	Asteraceae
17	Mustard leaves	Sarisha Shak	*Brassica napus* L.	Brassicaceae
18	Pea leaves	Motor Shak	*Pisum sativum* L.	Fabaceae
19	Indian pennywort leaves	Thankuni Pata	*Centella asiatica* L.	Apiaceae
20	Fern leaves	Dhake Shak	*Diplazium esculentum*	Athyriaceae
21	Chickling pea leaves	Kaloe Shak	*Lathyrus sativus* L.	Fabaceae
22	Fenugreek leaves	Maythi Shak	*Trigonella foenum-graecum* L.	Fabaceae
23	Goose foot leaves	Bathua Shak	*Chenopodium album* L.	Amaranthaceae
24	Slender carpet weed leaves	Gima Shak	*Glinus oppositifolius* L.	Molluginaceae
25	Sweet gourd leaves	Mistekumra Shak	*Cucurbita maxima* Duch.	Cucurbitaceae
26	Ash gourd leaves	Chal kumra Shak	*Benincasa hispida* (Thunb.) Cogn.	Cucurbitaceae
27	Taro leaves	Kachu Shak	*Colocasia esculenta* L.	Araceae
28	Starthorn leaves	Sulmardon Shak	*Hygrophila auriculata* (Schum.) Heyne.	Acanthaceae

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II. Experimental

Sample collection

The leafy vegetables (Table-1) were collected from different places such as from local market, paddy field, crop field or side of river of Dhaka, Gazipur and Barisal District. Each of the collected fresh vegetable samples was washed with water to remove mud and dust particles. The cleaned raw plant material was first dried at room temperature and then in an oven at 45°C. The dried plant material was grinded to powder by a Cyclotec grinder (200 meshes) and the powder was stored in air tight bottle. The dried vegetable powder was used for estimation of ash and iron analysis. Total vitamin C and water content were determined using fresh vegetable sample. The taxonomy of the plants was confirmed in consultation with an expert in the Department of Botany, University of Dhaka, Bangladesh. A voucher specimen of each plant was deposited in the Bangladesh National Herbarium (BNH).

Determination of Different nutrients

The water, ash, iron, and total vitamin C content of the leafy vegetables (Table-1) were determined following standard procedure[3-5]. Each of the samples was collected from three different places and each parameter was determined in triplicate. The average value of three determinations was used in presenting result of each parameter for each sample. The values of water and total vitamin C content were expressed on fresh sample basis. The values of iron content and ash content were expressed on dry powder basis. The results are given in Table-2.

Table 2. Composition of leafy vegetables

Serial No.	Name of the sample	Results (mean ± s.d.)			
		Water content*	Ash content**	Ascorbic acid content†	Iron content‡
1	Turnip leaves	84.4 ± 0.4	10.25 ± 0.1	191.5 ± 1.7	15.79 ± 0.2
2	Joseph's coat leaves	91.5 ± 0.7	17.00 ± 0.1	76.5 ± 1.5	55.11 ± 0.9
3	Garden spinach leaves	95.5 ± 0.2	18.75 ± 0.3	41.2 ± 1.4	41.65 ± 0.4
4	Coriander leaves	88.0 ± 0.5	20.25 ± 0.3	140.5 ± 0.8	41.18 ± 1.2
5	Cauliflower leaves	92.9 ± 0.6	13.20 ± 0.1	165.6 ± 1.0	19.39 ± 0.7
6	Radish leaves	93.5 ± 0.3	20.50 ± 0.2	139.5 ± 0.5	64.31 ± 1.1
7	Onion leaves	89.6 ± 1.1	8.00 ± 0.5	29.0 ± 1.0	26.50 ± 0.5
8	Bottle gourd leaves	92.8 ± 0.8	14.50 ± 0.2	89.0 ± 1.0	38.11 ± 1.1
9	Sweet potato leaves	91.7 ± 0.3	12.00 ± 1.0	28.8 ± 0.8	32.84 ± 0.8
10	Marsh herb leaves	91.6 ± 0.4	15.00 ± 0.5	30.1 ± 0.7	49.04 ± 1.0
11	Water spinach leaves	92.6 ± 0.5	16.01 ± 0.3	36.4 ± 0.9	21.53 ± 0.5
12	Amaranths leaves	90.0 ± 0.8	16.74 ± 1.1	42.2 ± 0.7	37.05 ± 0.9
13	Jute leaves	83.8 ± 0.7	11.60 ± 0.3	107.2 ± 1.0	58.03 ± 1.0
14	Indian spinach leaves	94.5 ± 0.8	16.28 ± 0.2	66.7 ± 0.7	44.57 ± 0.5
15	Mint leaves	85.2 ± 0.2	11.83 ± 0.4	32.6 ± 0.5	61.12 ± 1.0
16	Garden lettuce leaves	94.9 ±0 .9	11.26 ± 0.3	21.6 ± 0.5	46.52 ± 0.5
17	Mustard leaves	92.1 ± 0.9	16.27 ± 0.5	35.5 ± 0.5	21.53 ± 0.5
18	Pea leaves	87.7 ± 0.6	8.70 ± 0.4	38.0 ± 1.0	33.04 ± 1.0
19	Indian pennywort leaves	87.5 ± 0.4	13.10 ± 0.5	42.9 ± 0.9	35.74 ± 0.3
20	Fern leaves	91.2 ± 1.0	11.00 ± 0.4	27.8 ± 0.7	24.71 ± 0.3
21	Chickling pea leaves	87.7 ± 0.3	11.22 ± 0.6	59.1 ± 1.0	42.76 ± 0.8
22	Fenugreek leaves	86.5 ± 1.2	10.30 ± 0.3	94.8 ± 1.1	21.54 ± 0.5
23	Goose foot leaves	84.3 ± 0.6	22.60 ± 0.6	36.0 ± 0.5	11.78 ± 0.7
24	Slender carpet weed leaves	86.4 ± 1.2	16.37 ± 0.2	88.0 ± 1.5	78.24 ± 0.8
25	Sweet gourd leaves	90.5 ± 0.4	14.60 ± 0.4	102.8 ± 1.3	36.05 ± 0.9
26	Ash gourd leaves	91.5 ± 0.2	15.00 ± 0.3	79.2 ± 1.2	42.10 ± 0.9
27	Taro leaves	91.9 ± 0.9	13.70 ± 0.3	69.6 ± 0.5	14.25 ± 0.2
28	Starthorn leaves	90.5 ± 0.5	17.20 ± 0.7	39.7 ± 1.7	48.15 ± 0.7

*g /100 g fresh vegetables; **g /100 g dry vegetable powder; †mg /100 g fresh vegetables; ‡g /100 g dry vegetable powder.

III. Results and Discussion

Twenty eight different leafy vegetables (Table-1) were collected locally and their moisture, ash, iron and total vitamin C content were determined[3-5]. Each parameter was determined for three different varieties of the same sample and each of the estimation was repeated for thrice. The average values are presented in Table-2.

It appears from the Table-2 that the water content varies from 83.8 to 95.5 g/100 g in fresh samples. The water content of garden spinach leaves is found to be the highest (95.5 g/100 g) and lowest (83.8 g/100 g) in jute leaves. The water contents of the leaves of garden lettuce (94.9 g/100 g) and Indian spinach (94.5 g/100 g) are closer to the highest value. On the other hand the water contents of the leaves of radish (93.5 g/100 g), cauliflower (92.9 g/100 g), bottle gourd (92.8 g/100 g), water spinach (92.6 g/100 g), mustard (92.1 g/100 g), taro (91.9 g/100 g), sweet potato (91.7 g/100 g), marsh herb (91.6 g/100 g), Joseph's coat (91.5 g/100 g), ash gourd (91.5 g/100 g), fern (91.2 g/100 g), sweet gourd (90.5 g/100 g), starthorn (90.5 g/100 g) and amaranths (90.0 g/100 g), are very close. The water contents of other vegetables are a little bit higher than the lowest value.

The ash content of goose foot leaves is found to be the highest (22.60 g/100 g) and lowest (8.0 g/100 g) in onion leaves. The ash contents of the leaves of radish (20.50 g/100 g), coriander (20.25 g/100 g), garden spinach (18.75 g/100 g), starthorn (17.20 g/100 g), Joseph's coat (17.00 g/100 g), amaranths (16.74 g/100 g), slender carpet weed (16.37 g/100 g), Indian spinach (16.28 g/100 g), mustard (16.27 g/100 g) and water spinach (16.01 g/100 g), are closer to the highest value but these are almost double or more than that of the lowest value. This indicates that the leafy vegetables contain different types of minerals which are very important for human.

The iron content of the samples was determined by formation of iron(II)-1,10-phenanthroline complex followed by measurement of the absorbance (at 510 nm) of the sample solutions[4]. Comparing this absorbance with that of standard samples, the proportion of iron in the respective samples was estimated. The results show (Table -2) that the iron content of the leafy vegetables varies from 11.78 to 78.24 mg/100 g of dry vegetable powder sample. It is found to be the highest (78.24 mg/100 g) in slender carpet weed leaves and lowest (11.78 mg/100 g) in goose foot leaves. The iron contents of the leaves of radish, mint, jute and Joseph's coat are found to be 64.31, 61.12, 58.03 and 55.1 mg/100 g of dry powder, respectively. The iron contents of the other vegetables are in between 12 and 49 mg/100 g of dry powder. These results indicate that the iron content in the leafy vegetable varies within wide range. This result provides an indication towards the utility of the leafy vegetables as a source of iron in our daily diet. The requirement of iron for an adult women and men are 18 mg and 8 mg per day[6]. It may be concluded from the results that about 50 g of the leafy vegetables may fulfill the requirement of our daily need.

The amount of total vitamin C is the highest (191.5 mg/100 g) in turnip leaves and the lowest (21.6 mg/100 g) in garden lettuce leaves. The amounts of total vitamin C in the leaves of cauliflower, coriander, radish, jute and in sweet gourd are found to be 165.6, 140.5, 139.5, 107.2 and 102.8 mg/100 g of fresh leaves, respectively. On the other hand total vitamin C contents in the leaves of Indian pennywort, amaranths, garden spinach, starthorn, pea, water spinach, goose foot, mustard, mint, marsh herb, onion, sweet potato and fern are estimated as 42.9, 42.2, 41.2, 39.7, 38.0, 36.4, 36.0, 35.5, 32.6, 30.1, 29.0, 28.8 and 27.8 mg/ 100 g of fresh leaves, respectively. The results indicate that total vitamin C content of the leafy vegetables varies widely and this information helps us to select these vegetables as a good source of vitamin C as diet in our daily food habit. Vitamin C is essential for the function of our immune system, as well as to repair our tissues and cells. Vitamin C also helps to protect our body from infection. Recommended requirement of vitamin C is about 45 mg per day for an adult[6]. About 100-150 g of leafy vegetables may fulfill our daily requirement of vitamin C.

From the present study, it is clear that the leafy vegetables are important source of minerals, iron and vitamin C. So, the poor people of the village of Bangladesh can survive on vegetables alone if they have nothing else to eat and this is generally found. Hence the findings, conclusively suggest that our local leafy vegetables are good source of nutrients as diet.

Reference

1. Mahbub, A., N. Jahan, T. Muslim and M. A. Rahman, 2010. Investigation of some constituents of two plants (*Alternanthera philoxeroides* and *Alternanthera sessilis*) of Amaranthaceae family. *Dhaka Univ. J. Sci*., **58**(2), 327-328.
2. Islam, M. R., D. K. Paul and R. K. Shaha, 2004. Nutrational importance of some leafy vegetables available in Bangladesh. *Pakistan J. Biol. Sci*., **7**(8), 1380-1383.
3. A.O.A.C., 1990. Official Methods of Analysis, 15th edition, Association of Official Analytical Chemists, Washington D.C., 739, 1250-1255.
4. Christian, G. D., 2004. Analytical Chemistry, 4th edition, John Wiley & Sons, New York, 598-99.
5. Alam, M. A., T. Muslim and S. M. M. Rahman, 1998. Comparative study of total vitamin C in various fruits and vegetables of greater Sylhet area. *Journal of Bangladesh Chemical Society*, **11**(1&2), 15-21.
6. World Health Organization, Food and Agricultural Organization of the United Nations, 2004. Vitamin and mineral requirements in human nutrition, 2nd Edition, World Health Organization.