

THE ANALYSIS OF CEYLON FOODSTUFFS

III.—SOME LEAFY AND NON-LEAFY VEGETABLES

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IN this paper the results of analysis of the most commonly used vegetables in Ceylon are presented and discussed. The vegetables, 28 in number, were purchased from the local market, as fresh material as possible being obtained. Moisture, protein, fat, carbohydrates, fibre and ash were determined by the standard methods. Of the mineral constituents only those considered most essential in nutrition—calcium, phosphorus, and iron—were estimated. With a view to having comparable results, exactly similar methods of analysis as those adopted in India (1) were employed, excepting in the case of fat, when petroleum ether was used in place of ordinary ether. The results of analyses are given in two tables, one containing those of the leafy vegetables and the other of the non-leafy types. The vegetables on the whole are of low calorific value, the average being only 36 calories per 100 grams of fresh material. Many of them are a fairly good source of minerals, the leafy ones being particularly rich in these. They contain a fairly high percentage of fibre, thus supplying the necessary roughage.

TABLE I
Leafy Vegetables

Name	Botanical Name	Sinhalese Name	Tamil Name	Moisture		Proteins		Ether Extract		Carbohydrates		Fibre		Mineral Matter		Calcium		Phosphorus		Iron mgm per 100 gms		Caloric Value per 100 gms	
				Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Amaranth (red)	<i>Amarantus paniculatus</i>	Tampala	Keerai	87.14	4.53	0.19	3.28	2.08	2.80	0.248	0.076	9.23	33.0										
Amarantus spp.	,, <i>viridis</i>	Kura-kola	Kuppai keerai	87.45	3.46	0.18	4.97	1.31	2.63	0.295	0.070	6.30	35.3										
Spinach	<i>Talinum</i> sp.	Gas-niviti	Pasali	94.53	1.70	0.19	1.59	0.66	1.33	0.152	0.041	2.97	14.9										
Agathi	<i>Sesbania grandiflora</i>	Kathurumurunga	Agaththi	78.97	7.03	0.54	9.83	1.19	2.44	0.490	0.072	7.71	72.3										
Kohila	<i>Lesia spinosa</i>	Kohila	Kohila	91.34	2.17	0.20	3.52	1.34	1.44	0.100	0.042	2.08	24.6										
Kankun	<i>Ipomea aquatica</i>	Kan-kun	Kangkun	86.51	4.41	0.45	5.70	1.57	1.36	0.064	0.023	2.95	44.5										
Radish	<i>Raphanus sativus</i>	Rabu-kola	Mullankiyilai	90.72	1.88	0.21	5.04	0.89	1.26	0.112	0.011	5.74	29.6										
Gotukola	<i>Centella asiatica</i>	Gotu-kola	Vallarai	84.26	2.89	0.34	8.63	1.79	2.09	0.206	0.041	9.59	49.1										
Amaranth (green)	<i>Alternanthera sessilis</i>	Mukunuvenna	Ponnankani	86.45	4.05	0.31	4.89	1.93	2.38	0.179	0.048	17.46	38.6										
Drumstick	<i>Moringa oleifera</i>	Murunga	Murungakai	77.12	8.05	0.92	10.66	1.01	2.24	0.387	0.075	5.20	82.9										

Murunga leaf.—This is the richest of all leafy vegetables analysed in the organic constituents and is a good source of minerals, particularly calcium and phosphorus. The tree is propagated easily by cuttings and needs very little attention. Soils, unsuitable for the cultivation of most other crops, can be utilized for growing this. It is known to stand drought conditions well.

Agathi.—In food value this is second only to *murunga*, but is the richest in minerals, chiefly calcium. The flower is not as nutritious as the leaf, the calorific value of the former being 36·5 as against 72·3 for the latter. The leaf as well as the flower is easily obtained at small cost. The tree itself can be grown on a wide range of soils and probably with success in almost all parts of the Island. Like all legumes it may be grown with other crops without serious competition for nitrogen in the soil.

Amarantus spp.—Two species of *Amarantus* are common and used for vegetable locally, but their nutritive value is not as high as that of *kathurumurunga*. They are however rich in iron and phosphorus, not quite so rich in calcium. Of the two species, the larger variety, *tampala* is slightly richer in proteins and iron than the smaller. Both are poor in fat.

Tampala can be easily cultivated on all types of soil under wide climatic conditions and needs but little attention. The smaller variety, *kurakola*, grows wild and can be collected with little trouble.

Kankun.—This is fairly rich in organic constituents, but is very poor in minerals chiefly calcium.

Gas-niviti—Spinach.—Contains a high percentage of water and is consequently of low calorific value, being the lowest of those analysed. Though reputed to be rich in iron the results obtained locally and in India indicate that it is poor in this constituent as well as in calcium and phosphorus.

Gotukola, Mukunnuvanna, and Kohila.—These are as high as most of the other leafy vegetables in food value, but in addition they are supposed to have special medicinal properties.

Mukunnuvanna however is remarkably rich in iron. *Kohila* is poor in minerals, particularly iron.

Radish leaf (rabu-kola) is of comparatively low food value. Its phosphorus content is the lowest of the leafy vegetables analysed but it contains fair amounts of calcium and iron.

TABLE II
Other Vegetables

Name	Botanical Name	Sinhalese Name	Tamil Name	Moisture		Proteins		Ether Extract		Carbohydrates		Fibre		Mineral Matter		Calorific Value per 100 gms
				Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
Brinjal	<i>Solanum melongena</i>	Battu	Kaththarikikai	90.51	1.03	0.15	6.09	1.63	0.59	29.8						
Ash plantain	<i>Musa paradisiaca</i>	Alu keselgedi	Valerikkai	73.40	0.69	0.29	24.18	0.47	0.97	102.1						
Snake gourd	<i>Trichosanthes anguina</i>	Pathola	Pudalankkai	94.79	0.67	0.09	3.27	0.87	0.32	16.6						
Bitter gourd	<i>Momordica charantia</i>	Karavila	Pavackai	90.58	1.40	0.09	5.31	1.01	0.91	27.7						
Red pumpkin	<i>Cucurbita maxima</i>	Wattakka	Poosanikkai	92.76	1.00	0.14	4.64	0.83	0.63	23.8						
Ash pumpkin	<i>Benincasa hispida</i>	Puhul	Sambal poosanikkai	96.74	0.25	0.07	1.87	0.73	0.34	9.1						
Luffa	<i>Luffa acutangula</i>	Vetakulu	Peerakanghai	95.63	0.96	0.09	2.57	0.38	0.37	14.9						
Cucumber	<i>Cucumis sativus</i>	Pipinja	Kekkarikkai	96.92	0.42	0.02	1.98	0.40	0.26	9.8						
Radish	<i>Raphanus sativus</i>	Rabu	Mullanki	92.19	0.80	0.06	4.77	1.16	1.02	22.8						
Cowpea	<i>Vigna unguiculata</i>	Me-karal	Pajyittankkai	88.34	2.86	0.04	6.89	1.26	0.61	39.4						
Beans	<i>Phaseolus vulgaris</i>	Bonchi	Ponchikkai	88.82	1.40	0.10	7.28	1.46	0.94	35.6						
Agathi flower	<i>Sesbania grandiflora</i>	Kathurumurunga mull	Agathhippoo	88.94	1.67	0.20	7.01	1.46	0.72	36.5						
Kohila rhizome	<i>Lasia spinosa</i>	Kohila ala	Kohilakkilangu	91.29	0.58	0.11	5.35	1.41	1.26	24.7						
Young jak	<i>Artocarpus integra</i>	Polos	Pillappinchu	86.45	1.78	0.47	8.89	1.65	0.76	46.9						
Matured jak	do.	Kos	Pillakkai	67.83	2.33	0.12	27.76	0.90	1.06	121.4						
Drumstick	<i>Moringa oleifera</i>	Murunga	Murungakai	89.30	2.21	0.11	4.54	2.89	0.95	34.7						
Ladies finger	<i>Hibiscus esculentus</i>	Bandakka	Vendikkai	91.82	0.94	0.07	5.42	0.99	0.76	26.1						
Breadfruit	<i>Artocarpus communis</i>	Del	Eerapilakkai	73.70	1.94	0.51	21.95	1.11	0.79	100.0						

Of the common non-leafy vegetables, jak, ash plantain, and breadfruit show highest caloric values, viz., 121, 102, and 100 respectively, due chiefly to their high carbohydrate contents. With the exception of cowpea which is a legume, jak shows the highest amount of protein. Jak and ash plantain are also comparatively rich in minerals, while breadfruit shows a high fat content. Young jak, *polos*, compares favourably with most other vegetables analysed but is of lower food value than mature jak. It is fairly rich in fat.

Drumstick.—The protein content of this fruit is fairly high and the food value itself will be relatively more if an analysis of the fleshy portion alone is carried out.

Ladies Fingers.—The moisture content of this vegetable is high, consequently the food value is low.

Gourds.—On account of the very high percentage of water in vegetables of this family, their food value is low and this is especially the case with cucumber which contains only three per cent. dry matter. Of these, bitter gourd shows the highest percentage of both protein and mineral matter.

Pumpkin.—Two varieties were analysed. The ash pumpkin has a moisture content almost that of cucumber and is equally low in nutritive value and minerals. The red variety is slightly richer, but the calorific value is still low. It is not such a rich source of carbohydrates as it is generally believed to be.

Legumes—Cowpea and Green Beans.—The former is twice as rich in protein as the latter, but has a low percentage of fat. The mineral content of green beans is higher than that of cowpea.

A glance at the tables would indicate that jak and ash plantain and breadfruit contain low percentages of moisture and are rich in carbohydrates, while *murunga* and *agathi* leaves, *kankun*, *tampala*, and *mukunuvenna* are relatively high in protein. None of the vegetables analysed show a high fat content, the highest value for ether extract being 0·92 per cent. in *murunga* and the lowest 0·02 per cent. in cucumber.

The results of mineral analyses of the leafy vegetables show that *mukunuvenna*, *gotukola*, and *tampala* are comparatively high in iron, whilst *kathurumurunga*, *murunga*, and the two species of *Amarantus* have high calcium and phosphorus contents. On

the whole the mineral and organic nutrient contents of local vegetables are lower than those of corresponding samples analysed in India. This is probably due to soil and climatic conditions. Analyses of vegetables from areas in Ceylon where limestone is prevalent would perhaps compare more favourably with the Indian data.

REFERENCE

Ranganathan, S., Sundararajan, A. R., and Swaminathan, M.—Study of the Nutritive Value of Indian Foodstuffs, &c. I. *Ind. Jour. Med. Res.* XXIV., 3, 1937.