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Nutritional composition of some lesser-known fruits used by the ethnic communities and local folks of Kerala

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Wild edible fruits play a significant role in the dietary requirements of the tribal and local communities of Kerala. Out of 218 species of fruit plants collected from the wild, fruits of ten species based on their individual merit were selected for chemical analysis. Estimation of moisture, protein, fats, reducing, non-reducing and total sugars, fiber, total mineral matter, vitamin C, iron, sodium, potassium and energy value were carried out and the results are compared with the nutritive value of ten common cultivar fruits.

Keywords: Wild edible fruits, Nutritional analysis, Ethnobotany, *Irular, Kadar*, *Paniyar*, *Malampandarangal,* Kerala

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Man needs an appreciable amount of nutrients in their diets to perform various body functions and to lead a healthy life. The nutrients include protein, fat, carbohydrate, vitamins and minerals. An average Indian man of 60 kg body weight doing moderate work requires 60 gm protein, 20 gm fat, 28 mg iron, 40 mg vitamin C, 2875 K Cal energy, etc. in his daily diet[1]. The dietary habits of ethnic communities in different regions are usually determined by the availability of local foods, and satisfaction of hunger is the primary goal of their food intake. They may not be nutrition specific in most occasions. The state of Kerala (8°17′-12°47′N and 74°51′-77°24′E) situated in the Southwest corner of Peninsular India with its varied eco-geographical and eco-climatic conditions are noted principally for its rich phytodiversity. Among a wide spectrum of wild species in its natural catchments, the fruit plants form the major supplier of subsidiary nutrition to the tribal and local communities.

Wild fruits provide nutrition for the forest dwellers and many of the marginalized rural communities since the common cultivar fruits are less familiar and not reachable for them. To the contrary, the wild fruits, which the tribes use, are not familiar to the urban communities. The tribal population in the state estimated to be 2,61,475 coming under 33 tribal communities, largely depend on the forest resources for their food and other livelihood[2,3]. Although they extract from the forests a portion of the wild fruits in excess of their requirements, huge quantities are usually wasted uncollected. This is mainly because of the fact that their availability and use are non-compensatory, and at the same time, its potential as a subsidiary food source is practically unknown to the other village and urban communities. Information available on the edible as well as therapeutic properties of the wild fruits is isolated and data on their nutritional composition are negligible[1,4,5]. Since the food and phyto-resources are shrinking globally with the hike in population, it is the need of the hour to find new alternatives for enriching the resource base of our food basket. It is in this aspect that the study focuses attention. Out of 218 wild edible fruits reported from the forests of Kerala, 10 fruits based on their individual merit and desirability are analyzed for their nutritional value and are compared with 10 common cultivar fruits[6].

Methodology

Surveys through the forests of Kerala to locate and identify the edible fruit plants were carried out as part of the Western Ghats Development Programme (WGDP) over a period of 5 yrs and the fruit samples for nutritional analysis were collected fresh from the forest. Flowering and fruiting specimens were also collected as vouchers for herbarium that on processing were correctly identified and matched with authentically identified sheets deposited in TBGT. Voucher specimens were deposited in TBGT for

future reference. Fruits were analyzed on fresh weight basis[7]. Moisture content was analyzed following oven dehydration at 70°C, protein using micro-kjeldahl method (N × 6.25 conversion factor), fat using petroleum ether soxhlet extraction procedure, reducing sugars by dinitrosalicylic acid (DNS) method, total carbohydrates by anthrone method, non reducing sugars by difference, fiber by digestion in dilute acid (H_2SO_4) and alkali–NaOH ash (total mineral matter) by incineration at 600°C in a muffle furnace, vitamin C by 2,6 Dichlorophenol-indophenol (DCPIP) method, iron using spectrophotometer (Systronics 106), sodium and potassium by a Systronics modiflame 127 flame photometer and energy values using Atwater's equation[8-10].

Results and discussion

Plant species selected for nutritional evaluation are listed with botanical name, family, vernacular or local name(s), and ethnic uses (Table 1); and the results are also summarized (Table 2). All the fresh fruits analyzed register much moisture, with a minimum (78.8%) in *Palaquium ellipticum* and maximum (92.43%) in *Aporusa lindleyana*. Increase in moisture content reduces the proximate principles such as fat, protein and carbohydrate, there by decreasing the energy value[11]. Since an increase in any of these three factors or the factors together proportionately increases the energy value, they are interrelated with moisture and energy. It is because of this fact that the species such as *Aporusa lindleyana* (34.44 K Cal) and *Palaquium ellipticum* (108.39 K Cal) stands much apart in the energy holding capacity. This is true with the common cultivated fruits also. Papaya (32 K Cal) and sapota (98 K Cal) with extreme values in energy holding are simply due to variations in their moisture content (papaya, 90.8%; sapota, 73.7%) as well as proximate principles.

Alangium salvifolium subsp s*undanum* ranks first in protein content (3. 89%) and it is much higher an amount compared to all the 10 cultivated fruits (Table 2). Among wild fruits, *Aporusa lindleyana* (0.02%) registered lowest protein value, which is however lesser an amount compared to the lowest value (0.2%) reported in apple. *Palaquium ellipticum* is high with fat (7.03%), whereas the fruits of *Ixora coccinea* registered minimum (0.01%). The percentage of sugars in *Ixora coccinea* (16.2%) is comparatively high as that of sapota (21.4%) and *Aporusa lindleyana* register the lowest value (5.98%), which is however comparable to the lowest value reported in papaya (7.2%).

Fruits of *Antidesma ghaesembilla* register top value (10. 79%) in reducing sugars whereas the value of

Table 1—Ethnic uses and phenology of the species analyzed

Plant name/Family	Local name	Uses
Alangium salvifolium subsp *sundanum* (Miq.) Bloem. Alangiaceae	*Ottangadi, Kilikuthi-ppazham*	*Malampandarangal* and *Kattunaykkar* eat ripe fruits. Seeds and bark contain alkaloids alangin A, B and alanginine[12].
Antidesma ghaesembilla Gaertn. Euphorbiaceae	*Kattu-pulinchi*	*Kanikkar, Malampandarangal, Paniyar* and *Kattunaykkar* eat ripe fruits; fruits edibility[13,14]. Sour unripe fruits are pickled.
Aporusa lindleyana (Wt.) Baill. Euphorbiaceae	*Ponvetti, Vetti*	*Kanikkar* and *Malampandarangal* eat juicy and translucent aril.
Baccaurea courtallensis (Wt.) Muell. - Arg. Euphorbiaceae	*Mootippuli, Mootti*	*Kanikkar, Malampandarangal* and *Paniyar* eat ripe fruits. The aril is sweetish sour and the rind is pickled.
Debregeasia longifolia (Burm.f.) Wedd. Urticaceae	*Neerinch, Monili*	*Muthuvar* and *Malampandarangal* eat the ripe fruits; fruits edibility[15,16]. Birds eat away ripe fruits[17,18].
Garcinia gummi-gutta (Linn,) Robson Clusiaceae	*Kodampuli, Pinampuli*	All tribes and local folks collect fruits for its rind. Dried rind is the camboge of commerce, used in curries as a souring agent.
Ixora coccinea Linn. Rubiaceae	*Thetti,Chethi, thechi*	The local folks and tribes, especially by children, eat ripe fruits.
Mimusops elenji Linn. Sapotaceae	*Elenji*	Ripe fruits edible[19]; seed powder mixed with ghee avoids constipation [20,21]; seed oil antiseptic[22,23].
Palaquium ellipticum (Dalz). Baill. Sapotaceae	*Pali, Bali*	*Malampandarangal, Irular, Kadar* and *Paniyar* eat ripe fruits. Seed oil is suitable for illumination[24].
Tamilnadia uliginosa (Retz.) Tirvengadum & Sastre	*Pindichakka*	*Paniyar* and *Kattunaykkar* cook the fruits after removing the seeds; fruits edible[25]. Fruit extract is used against diarrhoea and dysentery[26]. Fruit pulp is applied on boils[27-29].

Table 2—Nutritive value of wild fruits compared with cultivated fruits

Factors	Species									
	1/apple	2/pineapple	3/guava	4/jackfruit	5/mango-steen	6/pome-granate	7/sapota	8/mango	9/papaya	10/amla
Moisture	83.89/84.6	82.83/87.8	92.43/81.7	87.33/76.2	81.72/84.9	86.91/78	82.29/73.7	79.27/81	78.8/90.8	86.6/81.8
Protein	3.89/0.2	1.81/0.4	0.02/0.9	0.95/1.9	3.01/0.5	0.61/1.6	0.28/0.7	1.29/0.6	1.38/0.6	0.58/0.5
Fat	0.23/0.5	0.95/0.1	1.16/0.3	2.09/0.1	2.31/0.1	0.21/0.1	0.01/1.1	2.76/0.4	7.03/0.1	0.24/0.1
R sugar	6.54/UR	10.79/UR	4.91/UR	4.92/UR	7.15/UR	5.92/UR	10.15/UR	8.9/UR	7.75/UR	6.6/UR
NR sugar	2.84/UR	1.42/UR	1.06/UR	2.47/UR	2.77/UR	2.67/UR	6.05/UR	6.3/UR	2.15/UR	2.19/UR
T sugars	9.38/13.4	12.21/10.8	5.98/11.2	7.4/19.8	9.92/14.3	8.6/14.5	16.2/21.4	15.2/16.9	9.9/7.2	8.8/13.7
Fiber	1.85/1	1.5/0.5	0.00/5.2	1.89/1.1	2.09/0.00	3.1/5.1	0.9/2.6	1.13/0.7	1.9/0.8	2.88/3.4
M matter	0.52/0.3	0.49/0.4	0.36/0.7	0.31/0.9	0.93/0.2	0.49/0.7	0.25/0.5	0.32/0.4	0.91/0.5	0.81/0.5
Vit C	117.8/1	111.2/39	Traces/212	Traces/7	3.92/0.00	Traces/16	Traces/6	3.27/16	4.95/57	62.19/600
Iron	0.01/0.66	0.76/2.42	3.71/0.27	1.56/0.56	7.31/0.2	Traces/1.79	Traces/1.25	0.59/1.3	0.34/0.5	1/1.2
Sodium	5.14/28	9.26/34.7	11.6/5.5	1.01/0.00	8.5/0.00	2.1/0.9	9.88/5.9	5.16/26	2.95/6	5.8/5
Potassium	179.65/75	303.96/37	346.09/91	102.43/0.00	193.5/0.00	169.7/133	197.69/269	98.54/205	105.5/69	170/225
Energy	55.15/59	64.63/46	34.44/51	52.21/88	72.51/60	38.73/65	66.01/98	90.8/74	108.39/32	39.98/58

Abbreviations: R sugar = Reducing sugar; NR sugar = Non Reducing sugar; T sugar = Total sugars; M matter = Mineral matter; UR = Unrecorded. Values of popular fruits are as folows[1]:
1. *Alangium salvifolium* subsp. *sundanum* (Miq.) Bloem. 2. *Antidesma ghaesembilla* Gaertn. 3. *Aporusa lindleyana* (Wt.) Baill. 4. *Baccaurea courtallensis* (Wt.) Muell. - Arg. 5. *Debregeasia longifolia* (Burm. f.) Wedd. 6. *Garcinia gummi-gutta* (Linn.) Robson 7. *Ixora coccinea* Linn. 8. *Mimusops elengi* Linn. 9. *Palaquium ellipticum*(Dalz.) Baill. 10. *Tamilnadia uliginosa*(Retz.) Tirvengadum & Sastre

non-reducing sugars are high in *Mimusops elengi* (6.3%) and in both cases *Aporusa lindleyan* registered minimum values (reducing sugars 4.91%, non-reducing sugars 1.06%). The indigestible complex polysaccharide molecules such as cellulose, hemicelluloses and lignin, which together constitute the dietary fiber (roughage), have some useful functions in the digestive system. It promotes more frequent bowel movements and reduces the symptoms of diverticulosis. Among the wild fruits analyzed, *Garcinia gummi-gutta* (3.1%), *Tamilnadia uliginosa* (2.88%) and *Debregeasia longifolia* (2.09%) are with high fiber content. Compared to guava (5.2%) and pomegranate (5.1%), these values are much lesser but much more than that of pineapple (0.5%), mango (0.7%), papaya (0.8%), apple (1.0%), jackfruit (1.1%), etc.

Vitamin C is very important in the daily food as it has a variety of roles in the life processes. Growing children, pregnant ladies and lactating mothers need relatively high amount of Vit C in their diet. Wild fruits are the only source of Vit C as far as the tribal and jungle dwellers are concerned. Among the wild fruits analyzed, *Alangium salvifolium* subsp *sundanum* (117.8 mg/100 gm), *Antidesma ghaesembilla* (111.2 mg/100 gm) and *Tamilnadia uliginosa* (62.19 mg/100 gm) tops with Vit C content. Although they are not comparable with the high amount of Vit C reported in amla (600 mg/100 gm) and guava (212 mg/100 gm), the values are appreciably high compared to the Vit C content of apple (1 mg/100 gm), sapota (6 mg/100 gm), pineapple (39 mg/100 gm) and papaya (57 mg/100 gm).

The mineral matter (ash) formed after burning a known amount of fruit sample is subjected for analyzing individual elements such as Na, K and Fe. Although these elements constitute only a small portion (@4.0%) of the body tissue, they are essential as structural components for carrying out many vital processes in the body. *Debregeasia longifolia* (0.93%), *Palaquium ellipticum* (0.91%) and *Tamilnadia uliginosa* (0.81%) ranked high with total mineral matter which is comparable to the mineral matter content of Jack fruit (0.9%), guava and pomegranate (0.7%). The lowest value in mineral matter content is reported in *Ixora coccinea* (0.25%), which is however comparable to the value (0.2%) reported in mangosteen. The iron content is maximum (7.31 mg/100 gm) in *Debregeasia longifolia* followed by *Aporusa lindleyana* (3.71 mg/100 gm). However, the values are much higher compared to most of the popular fruits such as pineapple (2.42 mg/100 gm), pomegranate (1.79 mg/100 gm), mango (1.3 mg/10 gm), sapota (1.25 mg/100 gm), amla (1.2 mg/100 gm), apple (0.66 mg/100 gm), jackfruit (0.56 mg/

100 gm), papaya (0.5 mg/100 gm), guava (0.27 mg/100 gm) and mangosteen (0.2 mg/100 gm).

The fruit of *Aporusa lindleyana*, in addition to its high moisture content and iron, also hold appreciable amount of sodium (11.6 mg/100 gm) and potassium (346.09 mg/100 gm). Compared to *Aporusa lindleyana*, cultivar fruits such as pineapple (34.7 mg/100 gm) and apple (28 mg/100 gm) register more amount of sodium. Among wild fruits, it was *Baccaurea courtallensis* registered with minimum amount of sodium (1.01 mg/100 gm), which is however more than the minimum amount reported in pomegranate (0.9 mg/100 gm). While *Mimusops elengi* showed the lowest amount of potassium (98.54 mg/100 gm), which is however more greater an amount compared to guava (91 g/100 gm), apple (75 mg/100 gm), papaya (69 mg/100 gm) and pineapple (37 mg/100 gm).

Based on the data analyzed, it is evident that some of the wild fruits, even though not tasty and desirable unlike the popular fruits, are more nutritional. For example, *Alangium salvifolium* subsp *sundanum* register top value in protein (3.89 g/100 gm), which is much higher an amount compared to the cultivated fruits (0.2 g/100 gm in apple to 1.9 gm/100 gm in jack fruit). Similarly, the fat content of *Palquium ellipticum* (7.03 gm/100 g) also exceeds the fat range (0.1 gm/100g m in pineapple, jack fruit, mangosteen, pomegranate and papaya to 1.1 gm/100 gm in sapota) of all the cultivated fruits. In the case of mineral matter content, *Debregeasia longifolia* stands high (0.93 gm/100 gm) as against the values (0.2 gm/100 gm in mangosteen to 0.9 gm/100 gm in jack fruit) among cultivated fruits. *Debregeasia longifolia* is also high in iron content (7.31 mg/100 gm) than that reported in all the ten cultivar fruits (0.2 mg/100 gm in mangosteen to 2.42 mg/100 gm in pineapple). It is the case with sodium and potassium also, in which *Aporusa lindleyana* remains unbeaten with top values (11.6 mg Na/100 gm and 346.09 mg K/100 gm) as against sodium (0.9 mg/100 gm in pomegranate to 34.7 mg/100 gm in pineapple) and potassium (37 mg/100 gm in pineapple to 269 mg/100 gm in sapota) ranges of all the 10 cultivated fruits subjected for comparison. Energy value of *Palaquium ellipticum* is also comparably high (108.39 K Cal) as against the top value reported in sapota (98 K Cal) both coming under Sapotaceae family. In the light of this investigation, it is evident that, further studies to find new, unconventional underutilized fruits from the wild is an urgent necessity, which will definitely enrich the fruit basket of the State and it is hoped that popularization of these fruits for the benefit of the rest of the communities will gain momentum.

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