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Chemical Composition and Proposed Use of Two Semi-wild Tropical Fruits

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ABSTRACT

The edible fruits of two native species of Southeast Asia, Baccaurea sapida *(Roxb.) Muell. Arg. and* Flacourtia jangomas *(Lour.) Raeusch, were analyzed for sugars, amino acids and minerals. The values obtained (*B. sapida *and* F. jangomas, *based on dry weight) are: protein 5·5%, 3·9%; vitamin C 178, 218 mg/100 g; fructose, α- and β-glucose and sucrose 21%, 21% total; Ca 169, 175; K 137, 158; P 177, 147; Fe 100, 118; Mg 105, 57 mg/100 g. Concentrations of amino acids, Na, Mn, Cu and Zn are also reported. These fruits would be useful as supplements to a balanced diet.*

INTRODUCTION

Baccaurea sapida (Roxb.) Muell. Arg. and *Flacourtia jangomas* (Lour.) Raeusch are two semi-wild trees which are distributed over the sub-tropical

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and tropical regions of Southeast Asia (Ochse *et al.*, 1966; Heywood, 1978). The trees belong to the Euphorbiaceae and Flacourtiaceae families, respectively. These species have been taxonomically described by Burkill (1935) and Heywood (1978). Medicinal properties of the species have also been discussed (Perry & Metzger, 1978).

Detailed chemical analyses of these fruits, however, have not been made. Nothing is known of the nutritive value of the fruits, except that they are rich in sugars. Fruit of *B. sapida* has been found to contain sufficient sugars to make high quality table wine (Mahanta & Rao, 1964; Mahanta *et al.*, 1964), whereas *F. jangomas* is used as the major ingredient for making jam. The fruits are palatable, bright in colour and are eaten fresh during the summer season when they ripen. Commercial use of these fruits has not been made, and the trees remain uncultivated and neglected.

The objective of this study was to evaluate these fruits as potential food sources that can supply a balanced diet to the population of the tropics.

MATERIALS AND METHODS

Materials

Fully ripe fruits of *B. sapida* and *F. jangomas* were harvested at Jorhat, Assam, India. Mature fruits of *B. sapida* are yellow, whereas fruits of *F. jangomas* are deep purple in colour.

Determination of chemical composition

The pulp of freshly harvested fruits was analyzed for moisture and pH. Titratable acidity was also determined from fresh pulp, as described by Ranganna (1977). Total Soluble Solids (TSS) were measured in the pure, fresh juice of the fruits using an Erma refractometer. Water-soluble carbohydrates were measured by the anthrone method (Fairbairn, 1953). Protein contents were determined by the Kjeldahl method. Vitamin C content was measured by titration with a standard solution of 2,6-dichloroindophenol (Association of Official Analytical Chemists, 1975). Total energy values were determined with a bomb calorimeter.

Individual sugars

Individual sugars were determined by gas chromatography according to the method of Kallio *et al.* (1985).

Minerals

Mineral analysis on lyophilized fruit samples was performed by the atomic absorption spectrophotometer procedure (Van Lierop, 1976) and boron measurement was based on the method of Grewling (1966).

Amino acid analysis

Lyophilized sample was hydrolyzed with HCl (6 N) and the hydrolysate was analyzed for individual amino acid composition using an amino acid analyzer following the prescribed procedure of the Beckman Company (Anon., 1976).

RESULTS AND DISCUSSION

The proximate analysis shows the fruits to contain considerable amounts of protein and vitamin C (Table 1). Both fruits are good sources of vitamin C, protein and energy when compared against the recommended daily dietary allowance (RDA) levels.

Sucrose is the dominant sugar in both *B. sapida* and *F. jangomas* (Table 2). Fructose content in *F. jangomas* is more than twice the amount in *B. sapida*. These results agree with the finding of Mahanta & Rao (1964), who identified only the presence of these sugars in *B. sapida* by paper chromatography. The two isomers of glucose found in the present

TABLE 1
Chemical Composition of the Fruits

Analysis	*RDA*[d]	Baccaurea sapida	Flacourtia jangomas
pH[a]	—	3·2	5·8
Moisture (%)[a]	—	92·3	63·5
Titratable acidity (%)[a]	—	1·47	0·75
Total Soluble Solids (%)[b]	—	9·6	8·8
Total Soluble Carbohydrates (%)[c]	—	30·6	23·4
Protein (%) (N × 6·25)[c]	44–56 g	5·45	3·85
Vitamin C (mg 100 g^{-1})[c]	60 mg	178	218
Energy (kcal g^{-1})[c]	2 000–2 800	4·28	4·42

[a] Based on fresh fruit pulp.
[b] Based on pure fresh fruit juice.
[c] Based on dry weight.
[d] Recommended daily dietary allowance.

TABLE 2
Gas–Liquid Chromatography Analysis of Individual Sugars of Fruit Pulp

Sugars	*Sugar content* (%)[a]	
	Baccaurea sapida	Flacourtia jangomas
Fructose	1·54	3·61
α-Glucose	7·15	6·43
β-Glucose	2·95	1·60
Sucrose	10·1	9·18

[a] Based on dry weight.

TABLE 3
Amino Acid Content of Fruit Pulp

Amino acids	*RDA*[a]	*Amino acid content* (%)[b]	
		Baccaurea sapida	Flacourtia jangomas
Alanine	—	0·258	0·187
Arginine	—	0·198	0·206
Aspartic acid	—	0·687	0·488
Cystine	—	0·011	0·013
Glutamic acid	—	0·586	0·457
Glycine	—	0·215	0·173
Histidine[c,d]	—	0·102	0·073
Isoleucine[c]	0·450–0·700	0·199	0·168
Leucine[c]	0·620–1·100	0·345	0·253
Lysine[c]	0·500–0·800	0·314	0·224
Methionine[c]	0·200–0·350	0·012	0·012
Phenylalanine[c]	0·220–0·300	0·190	0·171
Proline	—	0·194	0·180
Serine	—	0·182	0·137
Threonine[c]	0·305–0·500	0·172	0·156
Tyrosine	—	0·088	0·077
Valine[c]	0·650–0·800	0·246	0·214

[a] Recommended daily dietary allowance (g).
[b] Based on dry weight.
[c] Essential amino acid.
[d] RDA is not clearly established.

investigations have been reported for the first time. Fine table wine preparations from *B. sapida* by Mahanta *et al.* (1964) could now be attributed to the appreciable amount of sugar found in this fruit. The wine preparations from *B. sapida* compared well against the leading American sweet wine in taste and flavour.

The analysis of essential and non-essential amino acids shows a high level of aspartic and glutamic acids in both fruits (Table 3). The essential amino acid contents in *B. sapida* are generally higher than those of *F. jangomas*. The fruits contain approximately one-third to half the RDA values of essential amino acids, except methionine. It is interesting to note that the same amount of methionine is found in both fruits (Table 3).

The mineral contents of these semi-wild fruits, unknown before these investigations, are shown in Table 4. Calcium contents in both fruits are relatively high and constitute 14% to 22% of the RDA values in both fruits. These fruits can be considered as good sources of calcium, particularly in developing countries where milk and milk products are in short supply. The fruits are also good sources of phosphorus.

Potassium contents of *B. sapida* and *F. jangomas* are relatively high. Sodium in both fruits is appreciable but not high enough to exclude the fruits from sodium-restricted diets.

The iron content in the fruits is very high. The iron content in these fruits exceeds the RDA values by more than six-fold. These fruits also contain high amounts of magnesium and zinc.

TABLE 4
Mineral Content of Fruit Pulp

Minerals	*RDA*[a]	*Mineral content*[b]	
		Baccaurea sapida	Flacourtia jangomas
Phosphorus	800–1 200	117	147
Calcium	800–1 200	169	176
Potassium	1 525–4 575	1 370	1580
Sodium	1 100–3 300	49·7	45·7
Iron	10–18	100	118
Magnesium	300–400	105	56·6
Boron	—	18·6	19·3
Manganese	2·5–5·0	4·51	12·7
Zinc	15	4·41	5·51
Copper	2–3	1·91	1·52

[a] Recommended daily dietary allowance (mg).
[b] mg/100 g of dry weight.

The present results show the potential of these semi-wild fruits as food products that could provide important nutrients for the population. This is particularly relevant for the developing countries of Southeast Asia where the fruit trees grow naturally. Malnutrition can be reduced if these fruits are used as food supplements. Jam, juice and wine industries of the region could be based on the mass production of these fruits. Research is needed to explore these and other lesser known tropical fruits in order to reduce our dependency on the relatively few fruits that are being cultivated at present. This paper illustrates the fact that some tropical fruits are neglected, not because of any inherent inferiority in quality, but due to the lack of scientific research on them, which is concentrated instead on the temperate fruits.

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