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Evaluation of nutritional, phytochemical and antioxidant properties of *Garcinia pedunculata* fruit

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ABSTRACT

This study investigates the nutritional and phytochemical composition of matured fresh fruit of *Garcinia pedunculata*, emphasizing its antioxidant properties. The proximate analysis reveals the fruit is composed of 89.44% moisture, 0.535% crude protein, 0.242% crude fat, 0.436% ash, 3.15% crude fiber, and 3.31% carbohydrates. Titratable acidity and Vitamin C content were measured at 2.89% and 36.98 mg/100g, respectively. Phenolic and flavonoid content analyses show that the ethanolic extract of the aril contains the highest concentrations, followed by the pulp. The aril's water extract also demonstrated superior phenolic and flavonoid levels compared to earlier studies. The antioxidant capacity was assessed using ABTS and DPPH assays, with the ethanolic extract of the aril exhibiting the highest activity, as indicated by lower IC_{50} values (102.9±2.8 µg/ml for ethanolic and 158±6.6 µg/ml for water extracts). The ABTS assay displayed higher sensitivity than the DPPH assay, consistent with previous findings. These results highlight *Garcinia pedunculata* as a rich source of polyphenols and flavonoids, contributing its antioxidant activity.

Figures : 03 References : 19 Tables : 03
KEY WORDS : Antioxidant activity, Flavonoids, *Garcinia pedunculata,* Phenolics, Phytochemicals

Introduction

Underutilized fruits are valued for their distinctive nutritional composition and medicinal benefits. These fruits are not cultivated on a large scale and have limited availability in local markets due to the absence of an established supply chain. Manipur is home to many such underutilized fruits, one of which is *Garcinia pedunculata*, locally known as "Hebung". This fruit possesses numerous medicinal properties and has been traditionally used in Manipur's folk medicine for treating digestive issues, stomach disorders, asthma, gout, and bone fractures [9,11,16]. It is also distributed in other states of North Eastern India and some parts of West Bengal.

Garcinia pedunculata belongs to the Clusiaceae family and typically thrives in evergreen and semi-evergreen forests, growing to a height of approximately 15–20 meters. The mature fruit exhibits a greenish-yellow hue and is primarily available from January to April, though its availability may extend until June[7]. In Manipur, the fruit is traditionally cooked with sugar and served as a special dish, particularly in the feasts of the Meitei community. In Assam, the raw fruit is commonly used for pickle making, while the ripe fruit is either eaten raw or cooked with fish, making it an integral part of Assamese cuisine[3].

As awareness of natural remedies and traditional ingredients grows, *Garcinia pedunculata* has gained attention not only for its culinary appeal but also for its

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TABLE-1 : Proximate constituent of *Garcinia pedunculata*

Parameter	% Composition (g/ 100g) FW
Moisture	89.44±0.46
Protein	0.535±0.01
Fat	0.242±0.03
Ash	0.436±0.015
Crude fibre	3.15±0.4
Titratable acidity	2.89±0.2
Carbohydrate	6.2
Vit C (mg/100g)	36.98±0.9

potential health-promoting properties. Traditionally, the plant has been utilized for many disorders like chronic phlegm, asthma, cough, bronchitis, fever, dysentery, cardiotonic and stomach-related diseases[6,8]. The pericarps of the fruits are extensively used as antiscorbutic, astringent, cooling, cardiotonic, emollient across the people of India, particularly NE states as a folklore medicine. It is also used in liver disease, spleen disorder, dyspepsia, anorexia, indigestion, difficult micturition, cough, respiratory disorders, ulcers, and skin diseases[10].

Considering its importance in ethnobotanical medicine, this study was undertaken to assess the nutritional composition, phytochemical properties, and antioxidant activities of *Garcinia pedunculata* fruit found in Manipur.

Materials and Methods

The ripe mature fruits of *Garcinia pedunculata* were collected from Kakching, Manipur (24.4975° N, 93.9863° E). The representative picture of the fruit is shown in (Fig. 1). Fruits were properly washed with plenty of distilled water and soaked the excess water with sterile tissue paper. Half of the edible portion pulp as well as aril was detached from seed using sterile steel knife was stored at cold (4°C) untiled used for proximate analysis.

Nutritional analysis : The moisture, crude protein, fat, crude fiber and ash content of the studied fruit sample were determined according to AOAC methods[1]. Carbohydrate content was calculated by difference method. Vitamin C (ascorbic acid) content of the fruit was determined by spectrophotometric method (2,4-dinitrophenyl hydrazine)[12]. Estimation of titratable acidity was performed[12].

Sample preparation : The mature *Garcinia pedunculata* fruit was separated into two portions : one is the pulp and another is the aril portion (Fig. 2). The fruit samples were chopped with a stainless-steel knife. Then the samples were dried and crushed into fine powder using kitchen blender. 10 g powder sample was infused with 100ml 70% ethanol in a 250ml flask with shaking at 160rpm (Spinix orbital shaker, Tarson) at room temperature for 24h. The extraction procedure was repeated for each 24h for continuous three days. The supernatant was pooled together and dried in rotatory vacuum evaporator at 40°C. For water extraction same procedure was followed by replacing 70% ethanol with distilled water and extractant was dried in lyophiliser.

Antioxidant assay

DPPH (2,2-Diphenyl-1-Picryl hydrazyl) assay

20 mg of extract was dissolved in 1 ml

TABLE-2 : Phenolic and flavonoid content of *Garcinia pedunculata fruit* extracts

Fruit extract	Phenolic(mg GAE/g extract)	Flavonoid(mg QE/g extract)
Ethanolic extract of pulp	9.62±0.67^{b}	7.62±4.0^{b}
Ethanolic extract of aril	13.2±0.72^{d}	11.6. ±1.7^{d}
Water extract of pulp	8.8±0.79^{a}	5.1±0.3^{a}
Water extract of aril	12.14±0.69^{c}	9.8±0.4^{c}

*****Values with the same alphabet in a column is not significant at 0.05 level*

TABLE-3 : Antioxidant activities of *Garcinia pedunculata fruit* extracts

Fruit extract	ABTS(µg/ml)	DPPH(µg/ml)
Ethanolic extract of pulp	172.3±8.5[d]	853.0±22.4[d]
Ethanolic extract of aril	102.9±2.8[b]	216.2±10.7[b]
Water extract of pulp	326.33±31[e]	1063.23±43[e]
Water extract of aril	158±6.6[c]	318.4±44.0[c]
Ascorbic acid	3.6±0.4[a]	7.2±0.6[a]

*****Values with the same alphabet in a column is not significant at 0.05 level*

methanoland used as stock for the antioxidant assay. 0.1 ml sample of different concentration was mixed with DPPH solution prepared in methanol (A_{517}=1.0±0.01) incubated for 30min at room temperature at dark. Decolourisation of purple colour was read at 517nm and calculated its percentage radical scavenging activity (%RSA) and IC_{50} of the fruit extract and standard ascorbic acid from the calibration curve. Ascorbic acid (AA) was used as standard antioxidant[17].

$$\%RSA = \frac{Acontrol - Asample}{Acontrol} X\ 100$$

2,22 -azino-bis (3-ethylbenzothiazoline-6-sulphonic acid) (ABTS) assay

ABTS radical scavenging activity was performed[17]. The reaction mixture containing 0.1mL of extract was mixed with 1.9mL ABTS radical (A_{734}=1.0±0.01) then incubated in the dark, and the absorbance was read at 734nm after for 30min. Ascorbic acid (AA) was used as standard antioxidant. RSA and IC_{50} of the extract were calculated.

Total Phenolic and flavonoid assay : The total phenolic of the fruit extract was analyzed by Folin Ciocalteu and aluminium chloride methods, respectively[18]. Phenolic content was expressed in milligram of gallic acid equivalent per gram of extract (mg GAE/g), whereas flavonoid and content was determined differently[2] and amount is expressed in milligram of quercetin equivalent per gram of extract (mg QE/g).

Statistical analysis : All the experiments were done in triplicates and values are presented as mean standard deviation. ANOVA analysis was done using SPSS 16 software.

Results and Discussion

The proximate content of matured fresh fruit of *Garcinia pedunculata* is presented in Table-1. The fruit is constituted by moisture (89.44±0.46%), crude protein (0.535±0.01%), crude fat (0.242±0.03%), and ash (0.436±0.015%), crude fibre (3.15±0.4%)and other carbohydrates (3.31±0.87%) (Table-1). Similarly, the

Fig. 1 : *Garcinia pedunculata plant*

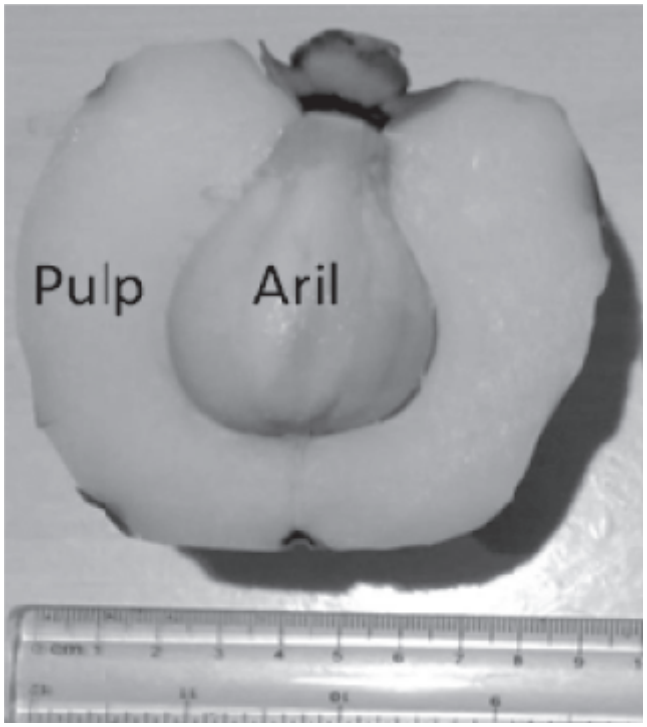

Fig. 2 : Ripe and Mature fruit of *Garcinia pedunculata* showing aril and pulp

proximate composition of *Garcina pedunculata* fruit was also reported as moisture 85%, Crude fat 0.44% ash 1.37%, Crude fibre 3.4 %. While, earlier worker[13] have reported that *Garcinia* fruit contained 88.47% moisture, 1.25% fat, 4.97 crude protein, 1.86% ash and 2.13 titratable acidity.The titratable acidity and Vitamin C content was recorded as 2.89±0.2% and 36.98±0.9 mg/100g. According to National Institutes of Health the dietary requirement of vitamin C content is 90 milligrams (mg) per day for men 75 mg per day for women. This indicates that consumption of 100 g of *Garcinia pedunculata* fresh fruit could provide approximately 1/3 of dietary requirement in men and ½ in women.

The phytochemical content of *Garcinia pedunculata* fruit extracts

The total phenolic and flavonoid content of the fruit extract is presented in Table-2. The ethanolic extract of the aril exhibited the highest levels of phenolic (13.2±0.72 mg GAE/g extract) and flavonoid compounds (11.6. ±1.7 QE/g extract), followed by the ethanolic extract of the pulp. Similarly, the water extract of the aril showed higher phenolic content (12.14±0.69 mg GAE/g extract) and flavonoid content (9.8±0.4mg QE/g extract) compared to previous findings by earlier worker[15] who reported total phenolic content (TPC) of 9.44±0.24 mg GAE/g extract and total flavonoid content (TFC) of 0.607±0.027 mg QE/g extract in the methanolic extract of *Garcinia pedunculata*. These differences could be attributed to various factors, such as climatic conditions and fruit maturity. Other ones[14] have reported that the *Garcinia pedunculata* fruit contained total phenolic content of 5.86 ±0.02 mg catechin/gram. While flavonoid content of *Garcinia pedunculata* fruit reported as 5.60 ±0.14 mg quercetin/gm. The fruit is a rich source of polyphenols and flavones. The presence of anthocyanin a well-known flavonoid is also reported[15]. Polyphenols and flavonoids are very important phytochemicals present in pants having biological activities beneficial to human health. They are excellent antioxidants[4]. These phytochemicals are used in herbal medicines. Flavonoids and various other phenolic compounds are recognized for their potent antioxidant, anticancer, and antibacterial properties. They also exhibit cardioprotective effects, anti-inflammatory benefits, and immune-boosting potential. Additionally, these compounds contribute to skin protection against UV radiation and are considered promising for pharmaceutical and medical applications[19].

Antioxidant activities of *Garcinia pedunculata fruit* extracts

The antioxidant activities of *Garcinia pedunculata* fruit extract was determined by two different methods such as ABTS and DPPH assay. The ethanolic extract of aril exhibited highest antioxidant activity in both the assays as indicated by its lower IC_{50} values (Table-3). The IC_{50} values for ethanolic and water extracts of aril was recorded as 102.9±2.8 µg/ml and 158±6.6 µg/ml respectively. The lowest antioxidant activity was observed in water extract of pulp in DPPH assay. All the extracts showed higher antioxidant activity in ABTS assay as compared to DPPH assay. This might be due

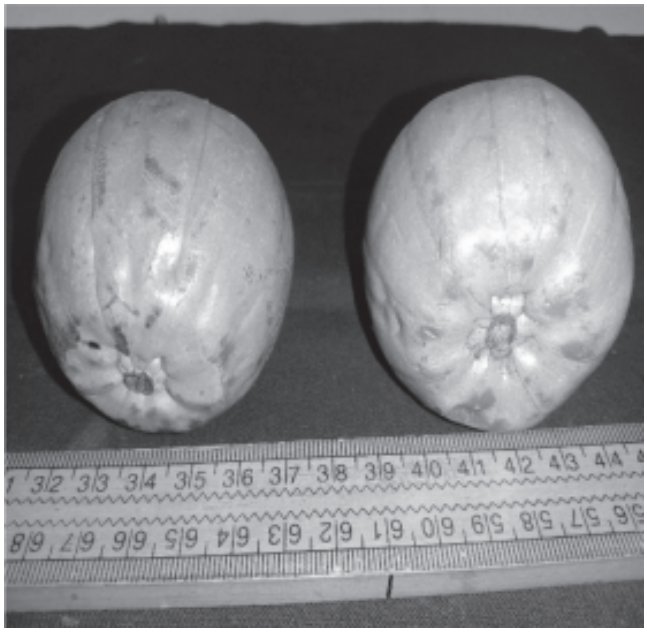

Fig. 3 : Unripe fruit

to the sensitivity of ABTS assay over DPPH assay. Similarly, investistors[5], have reported that ABTS assay might be more useful than DPPH assay for detecting antioxidant capacity in a variety of foods. Others[15] have reported the antioxidant activities of methanolic extract of *Garcinia pedunculata* fruit. The IC_{50} for DPPH was recorded as 493.30 ± 12.06µg/ml and that of ABTS as 535.70 ± 4.04 µg/ml.

Conclusion

The study highlights the rich nutritional and phytochemical composition of *Garcinia pedunculata*, emphasizing its high moisture content, essential nutrients, and significant levels of phenolic and flavonoid compounds. The ethanolic extract of the aril demonstrated the highest antioxidant activity, particularly in the ABTS and DPPH assays, indicating its potential as a potent antioxidant source. Overall, *Garcinia pedunculata* emerges as a valuable fruit with potential health benefits.

Declaration of conflict of interest

The authors declare that they have no conflict of interest.

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