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Nutritional Composition of Two Underutilised Leafy Vegetables (*Rungia pectinata* and *Dicliptera bupleuroides*)

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Study Area: Balasore, Odisha, India
Coordinates: 21°3' - 21°59'N; 86°20'-87°29'E

Key words: Medicinal plant, Nutritional values, Mineral contents

Abstract

Until now, tribal and rural people have enjoyed a variety of wild leafy vegetables that are unexplored by the common man. Nutritional properties of two such leafy vegetables *Rungia pectinata* and *Dicliptera bupleuroides* were evaluated in terms of moisture, ash, fiber, protein, carbohydrate, fat, and minerals. These two leafy vegetables are rich in calcium and potassium. Besides, they contain chlorine, sulphur, phosphorus, iron, silicon, manganese, titanium, chromium, copper, zinc, bromine, rubidium, and stadium. The results suggest that these two underutilised leafy vegetables are good sources of essential micronutrients in addition to the presence of nutrients. Hence, the inclusion of these leafy vegetables in our diet can supplement nutritional requirements necessary for overall good health, thereby protecting us against deficiency

Introduction

For millennia, indigenous communities have been dependent on wild edible plants to meet their needs, especially for food and medicine. Apart from being a rich source of dietary fibres, minerals, vitamins, proteins, and other nutrients, they possess medicinal values too. Unfortunately, due to the rapid erosion of traditional knowledge coupled with the dependency of the present generation on synthetic drugs, the potential of indigenous leafy vegetables is currently undervalued (Noor & Satapathy, 2020). Furthermore, the scientific community has yet to completely investigate their secret nutritional and therapeutic values for the benefit of humanity. In addition, consumption of indigenous leafy vegetables has declined drastically due to the excessive dependency of people on exotic vegetables and field crops. In recent times, there has been an urgent need to investigate and explore these plants as sources of nutrition for achieving food security and overcoming malnutrition worldwide. Furthermore, evaluating their phytochemical constituents and antimicrobial activity can result in the discovery of novel drugs.

Rungia pectinata (L.) Nees (Plate-1a), an underutilised green vegetable from the Acanthaceae family, is consumed by tribal and rural people after being stir-fried with other vegetables. It's a weedy annual procumbent or erect herb that grows in waste sites, forest undergrowth, semi-evergreen woodland, and along roadsides. The important phytochemicals present in this plant are phytosterols, terpenes, tannins, glycosides, flavonoids, phenolic compounds, amino acids, fixed oils, and so forth (Harborne, 1984). It is an ethnomedicinal plant that possesses antipyretic, analgesic, anti-inflammatory, diuretic, antifungal, and antimicrobial activities (Swain *et al.*, 2011; Swain *et al.*, 2008; Singh *et al.*, 2013). The leaf juice is considered cooling and aperient and is orally administered to children against smallpox. The external application of its bruised leaves relieves painful inflammations and swellings (Nadkarni, 2002). Besides, the tribes of Bihar state in India use the roots of this plant as febrifuges and vermifuges (Trease & Evans, 2002; Anonymous, 1996).

Dicliptera bupleuroides Nees (Plate-1b), a member of the Acanthaceae family, is also an ethnomedicinal plant. It's a hairy herb with a lot of branches. The majority of the flowers are pink, with a purplish shade in the centre. It's also eaten as a leafy vegetable by tribal and rural populations, commonly stir-fried alone or with other leafy vegetables. Plant decoction is used as a tonic, whereas its leaf pastes are used against eczema and leaf extract is used as an ear drop (Shah *et al.*, 2013). Plants contain triterpenoids, sterols, glycosides, flavonoids, alkaloids, proteins, carbohydrates, and tannins (Akbar *et al.*, 2021). In traditional medicine, this plant is used for snake bites, fevers, stomach troubles, and bone fractures (Panigrahi & Dubey, 1983).

Several studies have been done on the nutritional

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aspects of cultivated leafy vegetables. However, less attention is given to wild leafy vegetables. Therefore, the present study was carried out to evaluate the nutrient and mineral contents of two underutilised leafy vegetables, viz., *Rungia pectinata* (L.) Nees and *Dicliptera bupleuroides* Nees, are found in the Balasore district of Odisha, India. Further, being enriched in medicinal values, these leafy vegetables have the potential to fulfil both the nutritional and therapeutic demands of the human body. The present study may also be helpful for crop diversification and the sustainable utilisation of natural resources.

Plate-1: a) *Rungia pectinata*; b) *Dicliptera bupleuroides*

Methodology

Plant materials collection and preparation: plant samples of healthy, disease-free, underutilised leafy vegetables, namely *Rungia pectinata* (L.) Nees and *Dicliptera bupleuroides* Nees were collected from the wild in two different locations in the Balasore district, Odisha, India. From each leafy vegetable, six samples were taken. The Flora of Orissa and other standard literature were used to identify and certify the plants (Haines, 1921-1925; Mooney, 1950; Saxena & Brahmam, 1994-1996). Plants were then stored as herbarium specimens. The plant leaves were separated from the stalk and cleaned in distilled water. Leafy vegetables were shade dried for about a week or until completely dry for mineral analysis. In a blender, the dry samples were pulverised and kept in glass airtight containers for future use. The fresh leaves of these two test plants were used for the analysis of nutrients.

Nutritional Composition Analysis: the standard methods of Analysis of the Association of Official Agricultural Chemists (AOAC) (Horwitz & Latimer, 2005) were used for measuring the nutritional composition of these two underutilised leafy vegetables. Fresh leaf samples were dried in a hot air oven at 135°C for 2 hours to determine moisture content. The weight loss was calculated as a percentage of the moisture content using the following method (AOAC: 930.15). The fat content of the plants was estimated by extracting them in a Soxhlet apparatus using petroleum ether as per the following method (AOAC: 954.02). The fibre content was evaluated using a gravimetric method, and the plant material was digested using sulfuric acid and sodium hydroxide solution (AOAC: 962.09). Lowry's methodology was used to evaluate the crude protein content of fresh leaf samples of leafy vegetables (Lowry *et al*., 1951). The Anthrone method was used to determine the carbohydrate content of leafy greens (Yemm & Willis, 1954).

Statistical Calculation: all analyses were performed in triplicate. The mean and standard deviation were calculated using statistical software. The mean of three measurements was used to generate each nutritional analysis result, and the data is given as the mean $\pm$ standard deviation.

Mineral Analysis: using the X-ray Fluorescence (XRF) technology, the presence of various mineral elements in the leaf sample powder of two underutilised leafy vegetables was examined quantitatively. The elemental composition of the material can be measured quantitatively utilizing X-ray fluorescence spectroscopy, which is a non-destructive analytical technique. It can detect elements from Beryllium (Be) to Americium (Am) in concentration ranges from 100 wt% to sub-ppm levels. However, it cannot detect "light" elements such as lithium, beryllium, sodium, magnesium, aluminium, silicon, and phosphorus. XRF analysis was carried out at the Advanced Testing and Calibration Laboratory at Centurion University of Technology and Management, Odisha, Bhubaneswar. Epsilon 3 is the XRF analysis software platform used for determining the mineral composition of leafy vegetables.

Result & Discussion

The nutritional composition of the two underutilised leafy vegetables is shown in Table-1. The moisture content of *Dicliptera bupleuroides* is slightly high, *i.e*., 73.20%, as compared to *Rungia pectinata*, which has 71.43%). The high moisture content of these leafy vegetables indicates that although they are perishable, they help our body to rehydrate. The fibre content of leafy vegetables was found to be the highest in *D.bupleuroides* (10.40%) and the lowest in *R.pectinata* (8%). The presence of higher concentrations of dietary fibre helps in lowering cholesterol levels in the body, thereby reducing the possibility of heart disease (Hanif *et al*., 2006). Besides, it helps in relieving constipation and maintaining a healthy weight in our body. The two leafy vegetables have more or less similar amounts of fat content, *i.e*., 1.50 % in *D.bupleuroides* and 1.33 % in *R.pectinata*. The low value of fat content in these leafy vegetables is quite relevant to the overall observation that leafy vegetables have less fat, and it plays a vital function in preventing obesity (Nisha *et al*., 2012). The protein content of two leafy vegetables, *viz*., *D.bupleuroides* and Rungia pectinata, was 4.65% and 3.38.%, respectively. This suggests that these two leafy vegetables are relatively poor sources of protein. The carbohydrate content of *D.bupleuroides* was 10.87% while that of *R.pectinata* was 11.86%. Besides being the main

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Table 1: Nutritional composition of two selected underutilized leafy vegetables unit in percentage (mean ± SD)

Species	Moisture	Fiber	Fat	Protein	Carbohyd.
D.bupleuroides	73.20+ 1.10	10.40+0.03	1.50+0.05	4.65+0.02	10.87+0.23
R.pectinata	71.43 +0.92	8.00+0.02	1.33+0.04	3.38+0.23	11.86+0.26

Table-2: Mineral content of *Dicliptera bupleuroides*

Elements	Compound	Qty. (ppm)	Elements	Compound	Qty. (ppm)
Si	SiO_2	3271	P	P_2O_5	31600
S	SO_3	30700	Cl	Cl	62100
K	K_2O	273900	Ca	CaO	572700
Ti	TiO_2	712.5	Cr	Cr_2O_3	129.2
Mn	MnO	2000	Fe	Fe_2O_3	5000
Cu	CuO	376.2	Zn	ZnO	460.1
Br	Br	148.2	Rb	Rb_2O	156.3
Sr	SrO	604.7			

Table 3: Mineral content of *Rungia pectinata*

Elements	Compound	Qty. (ppm)	Elements	Compound	Qty. (ppm)
Si	SiO_2	4136	P	P_2O_5	32000
S	SO_3	30300	Cl	Cl	75900
K	K_2O	271500	Ca	CaO	536400
Ti	TiO_2	1700	Cr	Cr_2O_3	92.2
Mn	MnO	1200	Fe	Fe_2O_3	11700
Cu	CuO	169.8	Zn	ZnO	531.2
Br	Br	116.2	Rb	Rb_2O	268.2
Sr	SrO	492.9			

source of energy, carbohydrates play a crucial role in the metabolic pathways of our body. The comparison between the nutrient content of two leafy vegetables (Table-1) suggests that although they contain all the major nutrients, *i.e.*, carbohydrates, protein, and fats, they are not enough to satisfy the recommended dietary requirements. Therefore, they can be used as additional nutrient supplements in our daily diet.

The mineral content of two selected leafy vegetables is represented in Tables-2,3 respectively. The calcium and potassium contents were found to be high in both the leafy vegetables. The calcium and potassium content of *D.bupleuroides* are 572700 ppm and 273900 ppm, whereas the calcium and potassium contents of *R.pectinata* are 536400 ppm and 271500 ppm, respectively. Calcium is required for the maintenance of healthy bones and teeth, as well as muscular contraction, neuron function, blood coagulation, and the management of appropriate heart rhythm. Potassium maintains appropriate blood pressure, water balance, muscular contraction, and nerve transmission. Besides calcium and potassium, they are also rich in chlorine, sulphur, phosphorus, iron, silicon, and manganese. Other elements present in low amounts in these two leafy vegetables are Titanium, Chromium, Copper, Zinc, Bromine, Rubidium, and Strontium, which are essential for the human body.

The present study revealed the potential of wild leafy vegetables as sources of essential nutrients. Although they are less popular, they are included in the food baskets of tribal and poor rural people to meet food and nutritional security. However, they are not enough to fulfil the recommended dietary allowances; rather, they can supplement nutrients in our daily diet. Apart from being loaded with nutrients and minerals, they too possess medicinal values which can meet the healthcare demands of tribal and rural belts. Owing to their overlapping nutritional and medicinal values, they can be further explored to assess the antioxidant properties, anti-nutrient factors, heavy metals and toxicity of these leafy vegetables for their safer consumption.

Finally, the need of the hour is to bring more potent underutilised leafy vegetables with hidden potential under domestication and propagation for crop diversification. In the present scenario, these undervalued leafy vegetables require immediate attention for their commercial exploitation for the benefit of humanity. Awareness among people about their immense potential coupled with the involvement of the scientific community can help in their conservation and sustainable utilization.

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