

## Biochemical studies of weed plants used as leafy vegetables by tribes and people of Chhattisgarh with special reference to the secondary metabolites confer nutraceutical properties

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### Abstract

Wild edible plants not only provide food and fodder but also make significant contribution to the nutrition requirements life forms throughout the year. Leafy vegetables are the major sources of the nutritional components of the tribal and local population in remote parts of the Chhattisgarh. In present study photochemical screening of eight wild leafy vegetables i.e. *Amaranthus viridis* L., *Boerhaavia diffusa* L., *Cassia tora* L., *Cleome viscosa* Linn., *Corchorus trilocularis* Linn., *Ipomoea aquatica* Frosk., *Oxalis corniculata* L., *Portulaca oleracea* Linn.; commonly consumed by the tribal and local people of Chhattisgarh. The results of the study showed that all the selected wild leafy vegetables contain tannins. Moreover, Alkaloids and Flavanoids were also present in all the selected plants except *O. corniculata* and *C. viscosa*, respectively. On the other hand, saponins were absent in *O. corniculata* and *C. viscosa*. Terpenoids were present in *A. viridis*, *B. diffusa*, *C. viscosa*, *P. oleracea*. However, Glycosides were found absent in *C. trilocularis*, *P. oleracea* and *C. viscosa*. The overall results revealed that *I. aquatica* possessed the highest nutritional value and *A. viridis*, *B. diffusa* are rich in majority of phytochemical classes of compounds. Comparatively however, *O. corniculata* shows lowest nutritional and therapeutic potential due to the absence of majority of phytoconstituents.

Chhattisgarh “the herbal state” has 59772 Km<sup>2</sup> area of forest comprising rich and unique biological diversity of several plants, which account 44% of total geographical area of the state and 8.4 of country’s forest cover. Chhattisgarh Geography is diverse and thus is

very interesting. Tribal community follows their traditional knowledge generation to generation. Tribal’s possess a very rich cultural heritage and glorious history of ethno-medicinal knowledge which is very essential for survival. In India, the leaves of a large number of wild and cultivated plants are used as vegetables.

They have a very high protective food value and are very easy to grow. It is estimated that in India about 800 species are consumed as wild edible plants over the country. Green leafy vegetables are good source of nutrition. Many wild varieties are also used as leafy vegetables. They are a rich source of minerals, iron, calcium, potassium, magnesium, vitamin K, vitamin C, vitamin B complex etc.<sup>4</sup>. These provide phytonutrients like  $\beta$ -carotene, lutein and zeaxanthin, etc. Due to rich source of vitamins and minerals leafy vegetables help to keep the human body free from diseases such as intestinal disorder, cardiac disorders, cancer, diabetes etc. People who eat fruits and vegetables in their daily life have a lower risk of heart disease and some neurological disease<sup>9</sup>. Green leafy vegetables offer a variety of substances which are beneficial to the human health for example, *C. oleraceus* Linn. is very good source of protein, carbohydrate, fat and fibers which are rich in calcium and vitamin K. Calcium is necessary for healthy bones and teeth, Vitamin K helps in clotting of

blood and prevention of osteoporosis, to control high blood pressure and high cholesterol value<sup>5</sup>.

*Collection and sample extraction of plant material:* The plant materials were collected from the locality of Durg. The collected leaves were washed thoroughly with normal tap water, followed by sterile distilled water. These plant samples were shade dried and powdered. They were then extracted with hot distilled water using Soxhlet's apparatus till the colorless sample obtained.

*Proximate analysis:* The method of<sup>7</sup> was employed for the determination of the proximate composition. The soxhlet method was also employed in the determination. The Kjeldhal method, Anthrone method was used for protein, carbohydrate estimation respectively, while the crude fiber and fat contents were also determined<sup>2,3</sup>. Screening of the above selected leafy vegetables for various phytochemical constituents were carried out using standard method<sup>6,10</sup>.



*A. viridis* L.



*B. diffusa* L.



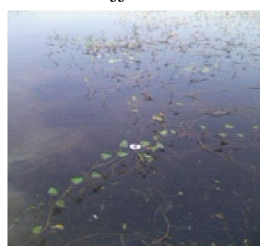
*C. tora* L.



*Cleome viscosa*



*C. trilobularis* Linn.



*I. aquatica* Frosk.



*O. corniculata* L.



*P. oleracea* Linn.

Tabel-1.1. An overview of the medicinal values of different leafy vegetables.

Sl. no.	Botanical name	Local name & Family	Medicinal value
1	<i>Amaranthus viridis</i> L.	Chauli Bhaji Amaranthaceae	A decoction of the entire plant is used to stop dysentery and inflammation. The root juice is used to treat inflammation during urination. It is also taken to treat constipation.
2	<i>Boerhaavia diffusa</i> L.	Patharri Bhaji Nyctaginaceae	Plant used for its anti-diabetic and diuretic properties also used for pain relief, anti-inflammation, and treating indigestion. Leaves also have anti-oxidant properties.
3	<i>Cassia tora</i> L.	Charota Bhaji Caesalpiniaceae	Leaves are used as laxative, anthelmintic, and antipyretic also used in cough, eczema. Effective in intestinal disorder, popular drug for jaundice, cures night blindness.
4	<i>Cleome viscosa</i> Linn.	Hurhuria sag Cleomaceae	The plant is anthelmintic and used to increase sweating to reduce fever. The leaf juice is digestive and good for ear pain.
5	<i>Corchorus trilocularis</i> Linn.	Chench Bhaji Tiliaceae	Leaves are used for pain, piles, and tumors. Plant is a folk remedy for aches and pains, dysentery, enteritis, fever, dysentery, pectoral pains, and tumors. Leaf decoction is used as demulcent and diuretic and Antioxidant.
6	<i>Ipomoea aquatica</i> Forsk.	Karmatta Sag Convolvulaceae	Tender leaves are used as vegetable which increase digestion. Leaves useful in diabetes and as galactagogue to nursing mother.
7	<i>Oxalis corniculata</i> L.	Tinpania Sag Oxalidaceae	Decoction is given in dysentery and diarrhea. The leaf juice is applied to insect bites, burns and skin eruption. The juice of plant, mixed with butter, is applied on muscular swelling, boils and pimples.
8	<i>Portulaca oleracea</i> Linn.	Gol sag Portulacaceae	Plant is refrigerant (reduces body heat), mild spasmodic, diuretic. Used in scurvy and in diseases of liver, spleen, kidney and bladder.

Table-1.2. Results of Nutritional Analysis of the selected wild leafy vegetables

Sl. no.	Botanical name	Moisture (%/100g)	Protein (g/100g)	Fat (g/100g)	Fibre (g/100g)	Carbohydrate (g/100g)
1	<i>Amaranthus viridis</i> L.	88.8	4.6	9.3	2.6	1.2
2	<i>Boerhaavia diffusa</i> L.	89.2	1.4	1.8	1.2	3.2
3	<i>Cassia tora</i> L.	85.2	1.3	2.2	0.9	1.6
4	<i>Cleome viscosa</i> Linn.	81.6	3.4	0.5	1.6	4.6
5	<i>Corchorus trilocularis</i> Linn.	83.1	4.7	0.5	2.1	12.5
6	<i>Ipomoea aquatica</i> Forsk.	93.3	5.4	11.0	3.7	13.5
7	<i>Oxalis corniculata</i> L.	68.0	1.6	0.4	2.1	7.1
8	<i>Portulaca oleracea</i> Linn.	83.3	1.9	0.5	1.5	11.7

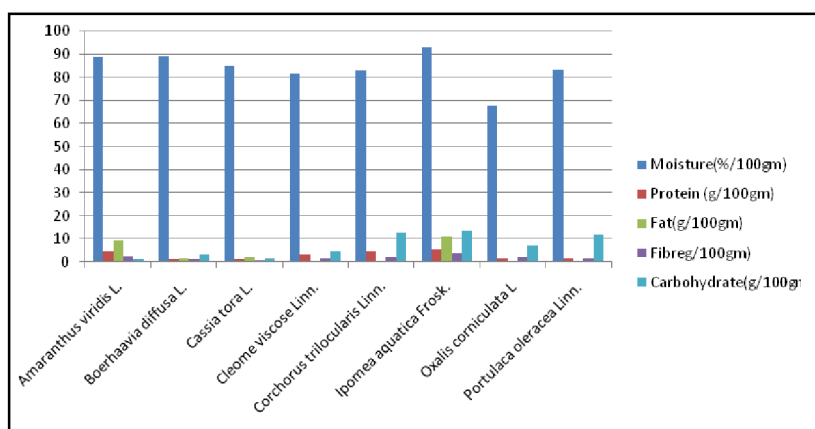
Figure 1.  
Comparison of the nutritional content of the selected wild leafy vegetables

Table-1.3. Results of secondary metabolites Analysis

Sl. no.	Botanical name	Alkaloid (Dragendroff's test)	Tannin (FeCl <sub>3</sub> test)	Saponin (Forth test)	Terpenoid (Salkowaski test)	Flavonoid (Lead acetate test)	Glycoside (Legal's test)
1	<i>Amaranthus viridis</i> L.	+	+	+	+	+	+
2	<i>Boerhaavia diffusa</i> L.	+	+	+	+	+	+
3	<i>Cassia tora</i> L.	+	+	+	-	+	+
4	<i>Cleome viscosa</i> Linn.	+	+	-	+	-	-
5	<i>Corchorus trilocularis</i> Linn.	+	+	+	-	+	-
6	<i>Ipomoea aquatica</i> Forsk.	+	+	+	-	+	+
7	<i>Oxalis corniculata</i> L.	-	+	-	-	+	+
8	<i>Portulaca oleracea</i> Linn.	+	+	+	+	+	-

In recent trends humans are being urged to increased consumption of fresh fruits and vegetables in their daily diet has come out to healthiest. Plants does not fulfill our basic food requirement but are also used for many purposes such as pharmaceuticals, fragrance, pesticides, cosmetics, dying etc. Chemical constituents of plants are the main site of interest from the very early days of modern science. In any biological system all organisms are ultimately made of essential elements like carbon, hydrogen, oxygen, nitrogen, phosphorus, calcium, magnesium, sulphur, etc. These elements are combined together in different ways to form complex organic compounds like fats, proteins, carbohydrates, enzymes, alkaloids, glycosides etc. These organic compounds are involved in different chemical reactions or metabolisms occurring in living cells and provide energy or matter for vital activities of organisms.

These biomolecules involved in these processes are called metabolites which are classified into two major categories: primary metabolites and secondary metabolites. In all living organisms primary metabolites are universally present which play significant role in metabolic pathways. They are related to energy linked life processes. Secondary metabolites are those compound which are biosynthetically derived from primary metabolites by different biosynthetic pathway such as : shikmic acid pathway, mevalonic acid pathway, acetate malonate pathway. They produced in small amounts and are restricted in accumulation but they play important role for plant survival, due to their specific functions. They are non essential for basic life processes and are directly not involved in the developmental processes. They are multifun-

ctional in nature: involve in seed dispersal, pollination, act as antifungal agents, anti – hervivore agent eg. cardiac glycoside against mammals, against natural enemies includes pathogen<sup>8</sup>.

Arrays of the phytochemicals are naturally occurring in plants. Interestingly however, they are important attributes of plant immune system .The fruits, vegetables and herbs contain natural substance. Unlike vitamins and minerals, they have no nutritional value. They can however influence various body processes. They work together with nutrients and dietary fiber to protect the body against diseases, slow the aging process and reduce the risk of many diseases such as cancer, osteoporosis, stroke, high blood pressure, heart disease, cataracts, and urinary tract infection. They also reduce LDL *i.e.* the cholesterol involved in depositing fat in the arteries and prevent blood clotting which can reduce the risk for a heart attack or a stroke<sup>1</sup>. Current study enlists the presence of different secondary metabolites found in eight different leafy vegetables used by local and rural population of Chhattisgarh.

The results of the proximate analysis as seen in table 1 revealed *I. aquatica* had the highest nutritional value moisture content 93.3%; Protein 5.4% ;fat 11.0;fibre, 3.7%;and carbohydrate13.5%. The high carbohydrate content showed that the *I. aquatica* can be a good source of food. Least moisture content was found in *O. corniculata*. The investigations have shown that 4.6%protein contents, 9.3% fat; 2.6% fiber and lowest carbohydrate value 1.2% found in *A. viridis* and *C. tora* had shown the lowest, 0.9% fibers contents. However, the leaves of *C. trilocularis* were

found to be the good source of protein, carbohydrate, and fiber. The present study reveals that Seven out of eight wild leafy vegetables shown presence of alkaloids. They are biologically active substances mainly found in fruits, vegetables, grains and other plant that have been linked to reducing the risk of major degenerative diseases. They are capable of supplying nitrogen and other necessary fragments to the plant development. Tannins are naturally occurring, water-soluble phenolic compounds. In the present study all the eight leafy vegetables were found to contain Tannins. The primary source of tannins used as an active pharmaceutical agent are from plants. Besides, tannins serve as an anti-inflammatory agent, treatment of wounds, burns, and have antiseptic potential. They are also used as antihelmintics, antimicrobials, antivirals, and antioxidants. Out of eight, six leafy vegetables shown presence of saponin. Saponins are chemicals that possess foaming characteristic. Saponins also confer several beneficiary effects such as reducing the risk of cancer, serving as antioxidants, providing immunity, etc. The triterpenoid saponins are generally predominant in cultivated crops, while steroid saponins are common in herbs or for their health promoting properties. In this study out of eight, four leafy vegetables showed presence of terpenoids. The modified or oxidized terpene is called as terpenoid. Terpenes are the largest group of secondary metabolites and are united by their common biosynthetic origin from acetyl-coA or glycolytic intermediates. Flavonoids are the most important groups of bioactive compounds

in plants. In this study, seven leafy vegetables out of eight possesses the flavonoids. Flavonoids possess diverse biological activities, *i.e.* antiulcer, anti-inflammatory, Antidiabetic, anticancer and as an antioxidant. Flavonoids are involved in UV filtration, symbiotic nitrogen fixation and floral pigmentation. They may also act as chemical messengers, physiological regulators, and cell cycle inhibitors. In the present study, *A. viridis.*, *B. diffusa.*, *C. tora.*, *I. aquatica* and *O. corniculata* shown the presence of glycosides. Most of the carbohydrates occur in plants as glycosides. Studies have shown that glycosylation reactions could be involved in the biosynthesis, modification, transportation and storage of other secondary metabolites. They reduce the toxicity of endogenous and exogenous toxic substances by their bioactivity, stability, solubility, sub cellular localization and binding property to other molecules.

The overall interpretation of the results of nutritional analysis and phytochemical investigations of the leafy vegetables has indicated some fascinating properties of these plant species. Interestingly, *I. aquatica* had the highest in nutritional value thus these leaves may be used as an easy accessible nutritional source. On the other hand, *A. viridis.* and *B. diffusa* might be of potential therapeutic efficacy as they possess majority of phytochemical compounds. Furthermore, the leaves *C. trilocularis* could prove to be the good source of protein, carbohydrate, and fiber. The findings incorporated in present study can however be subjected for future scientific investigation.

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