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## Use of underutilized green leafy vegetables as food nutrition and ethnobotanical among rural community of Odisha: A review

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### Abstract

In the current era of deforestation, well supported by gradual extinction of medicinally and economically important flora, traditional knowledge holds a valuable option in order to keep a balancing role towards biodiversity conservation leading to sustainability, hence needs to be focused and disseminated generation wise. Every crop has its own benefits to serve mankind. Green leafy vegetables are important group of nutrient dense commodity regarded as natures' anti-aging wonders, inexpensive food resource and a future herbal medicine owing to its concentrated and overloaded source of nutrients and phytochemicals. Unfortunately, some of them are still confined to local habitat and not explore commercially, accompanied by rare consumption. As leafy vegetables serve an important and diverse component in regular diet of rural and tribal communities satisfying nutritional need and contribute to livelihood as a food and medicine, hence can be considered as a potential tool to obtain sustainable agriculture, safeguarding the nature thus can be incorporated with other commercial crops leading to minimizing the scarcity of traditional food availability and danger of extinction. The current paper enlists the baseline information about medicinal properties, Nutritional quality and health benefits of some non-cultivated leafy vegetables from various regions of Odisha. Leafy vegetables, the commodity of nutritional significance is important horticultural produce and form integral part of the rural and tribal household.

**Keywords:** Ethnobotanicals, food security, leafy vegetables, nutrition, Phyto-neutraceuticals and underutilized

### Introduction

The world desperately over-dependent on fewer and specified plant species (Bhag Mal, 2007)<sup>[1]</sup>. Due to exponential increase in population and fast decrease in natural resources it became necessary to explore newer plant resources and their multifarious horizon (Joshi, 2005)<sup>[2]</sup>. In nature, there are many underutilized greens having promising nutritive value, which can nourish the ever-increasing human population (Sheela *et al.*, 2004)<sup>[3]</sup>. Green leafy vegetables in our country are known to be the most inexpensive source of several vital nutrients (Kamble and Jadhav, 2013)<sup>[4]</sup>. These are defined as the plant leaves along with tender petiole and shoot eaten as vegetable when the plants are in their young and active growth phase. They are not only short lived and herbaceous (with few exceptions with woody plants and creepers), but also rapidly growing plants and becomes ready for market in short period of time. Considering the abundance and nature of growth of the plant that are used for consumption, 71.4% constitutes Herbs being the primary source of leafy vegetables followed by 14.3% each constitutes trees and climbers (Panda *et al.*, 2015)<sup>[5]</sup>.

Leafy vegetables being nutrient dense and incredibly healthy in nature, blessed with an array of photochemical, anti-oxidant vitamins and minerals like beta-carotene, lutein, and zeaxanthin which protect our cells from damage also helps in alleviating the age-related problems, Tocopherols and polyphenols which is required for good health and protect against coronary heart diseases and cancer, vitamin A, C, K, Ca, Fe and P, K, Na, Zn respectively form an important place among all other vegetable crops (Lakshmi and Vimala, 2000; Negi and Roy, 2000; Fasuyi, 2006; Aberoumand and Deokule, 2009; Sudha and Mathangi 2012; Misra and Misra, 2014)<sup>[6,7,8,9,10,11]</sup>. These are also called as natures anti-aging wonders as they lower

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the age-related disorders and plays a key role in human health management due to its ability to lower the risk of chronic human ailments like cancer and cardio vascular diseases. These have the special power for uplifting the health profile of an individual as they are typically low in calories and rich in folic acid and dietary fiber content. Nutritional value of these greens is twenty times more than in other vegetables (Sudha and Mathanghi, 2012)<sup>[11]</sup>. Moreover, in the speeding up cost and their side effects, herbs or plant derived products are believed to have miraculous effect in modern days and remain the primary source of healthcare among  $\frac{3}{4}$  <sup>th</sup> of the world's population. Most modern-day medicines are directly or indirectly derived from plant sources.

Previously these leafy vegetables were restricted among rural community of certain geographical area but now a day a widespread network can be seen in markets of urban and Peri urban area selling with higher price due to preference of more of vegetables in their diet, increasing health consciousness, changing consumption pattern, living standards and life style. Hence in the age of speeding up medical cost and their side effects, peoples are intelligently and eagerly turning to natural medicines *i.e.*, herbs. Fortunately, India has highest number of vegetarians in the world where 40% of its population depends on vegetables and other plant foods for fulfilling their essential nutritional requirements. Studies have shown that vegetarians are less susceptible to disease and live longer, healthier and having stronger immunity (Akindahunsi and Salawu, 2005)<sup>[12]</sup>. In this way, leafy vegetables are not only popular but also getting momentum of their existence and dedicatedly offers an exclusive service to human society by its strong nutritional support. Cultivation of these vegetables will not only increase food production but also provide balanced nutrition, food security, health security and poverty alleviation to the deprived section (Buragohain *et al.*, 2013)<sup>[13]</sup>. Odisha lies between the latitudes 17.78 °N and 22.73 °N, and between longitudes 81.37°E and 87.53° E is 9th largest state by area and 11th largest by population covering an area of 1,55,707 km<sup>2</sup>. which supports a population of 41.94 million (Odisha economic survey 2014-15) and a population density of 270/km<sup>2</sup> respectively is considered to be a rich heritage of wild edibles and genetic paradise for its diversity in plant genetic resources (Misra *et al.*, 2012)<sup>[14]</sup>. There are 51349 villages (national health mission ministry of health and family welfare). Among which the tribes constitute a major share (22.43%) of the total state population (Meher, 2007)<sup>[15]</sup>. The state is having 10 versatile agro-climatic conditions which are immensely suitable for variety of crop. Approximately half of the state's people live below the poverty line, with limited access to exploitable resources due to a complex interplay of social, economic and cultural dynamics (State Health Systems Odisha). Like other indigenous communities, use of wild plants as food is an integral part of the culture and tradition of Odia people (Surjata and Korsam, 2016)<sup>[16]</sup>. A large section of the rural population meets their nutritional requirement through unconventional means by consuming various wild leafy vegetables along with water rice. As the winter sets the fragrance of leafy greens fills the kitchen across Odisha, found growing in kitchen garden, weed in agricultural fields, roadside, grazing fields, forests and water bodies.

These Green leafy vegetables have made impressive strides during last 5 years as these has been elevated from subsistence crop to a highly urge crop both in rural and urban fronts. The researcher made Location specific studies in India *viz.*, Jharkhand (Marandi and Britto, 2015; Horo and Topno, 2015)<sup>[17,18]</sup>, Maharashtra (Bhojane *et al.*, 2014)<sup>[19]</sup> south India (Jeeva *et al.*, 2006)<sup>[20]</sup>, West Bengal (Jana, 2007)<sup>[21]</sup>. In Odisha, Colossal studies have concentrated on south Odisha

by Sahu *et al.*, 2013<sup>[22]</sup>; Panda *et al.* 2015<sup>[23]</sup> in Bhadrak district, Pradhan and Panda, 2015<sup>[24]</sup> in Koraput, Misra and Mishra (2014)<sup>[10]</sup>, Tripathy *et al.* (2014)<sup>[25]</sup> in Similipal Bio-reserve Panda, 2014<sup>[26]</sup> and Misra *et al.*, 2012<sup>[14]</sup> in south Odisha.

There is scanty documentation and literature about the existence of underutilized leafy vegetables in India. Hence the scattered information on edible leafy vegetable diversity in Odisha are being compiled in this review paper and the current review also highlights about the basic knowledge, nutritional value, ecological occurrence, medicinal significance and expected future commercial horizon of some lesser Known and underutilized leafy vegetables but predominantly occupied and regularly consumed species by people of Odisha with an objective for its multi-dimensional exploitation.

### Distribution of diversified edible leafy flora

The diversity of vegetables consumed by humans varied widely both with geographical area and culture (Welbaum, 2015)<sup>[27]</sup>. There are more than 50,000 leafy crops in the world out of which more than 1,000 varieties are used as vegetables in one way or other. But the usages of green leafy vegetables are limited to specific geographical location (Ashok Kumar C.K *et al.*, 2013)<sup>[28]</sup>. It is estimated that in India about 800 species are consumed as wild edible plants, mostly by the tribal people (Bandyopadhyay and Mukherjee, 2009)<sup>[29]</sup>. These are chiefly categorized as cultivated indigenous vegetable like *Amaranthus sp.*, *Chenopodium album*, *Trigonella foenum-graecum*, *Raphanus sativus*, *Allium cepa*, *Cucurbita maxima*, *Momordica Charantia*, *Largenaria siceria*;; non cultivated naturally growing leafy vegetables like *Polygonum plebeium*, *Paederia foetida*, *Oxalis corniculata*, *Marselia minuta*, *Leucas aspera*, *Ipomea aquatica*, *Glinus oppositifolius*, *Enydra fluctuans* Lour, *Commelina Benghalensis*, *Celome viscosa*, *Colocasia esculenta*, *Brassica juncea*, *Bahunia purpurea*, *Bacopa monnieri*, *Alternanthera sessilis*; perennial greens like *Tamarindus indica* *Murraya koinigii* and *Moringa oleifera*; introduced leafy vegetables like *Spinacea oleracea*, *Basella rubra*. Odisha harbors a wide range lesser known but increasingly consumed leafy vegetable well distributed in 10 types of varies agro-climatic conditions. In Odisha many species of edible and wildy available species are appreciated as favorite cuisine and preferred in regular diet with water rice (boiled rice soaked overnight with water) after hard work in summer. Typically, available leafy flora signifies the flavour of Odia culture. Variety of leafy vegetables can be found growing in kitchen garden, roadside, grazing fields, weeds in agricultural fields, under growths in forests, marshylands and along water bodies, some greens are crunchy some are smooth with variety of taste to our taste buds like sour and bitter (Das, 2016)<sup>[30]</sup>. A world vegetable survey showed that 402 vegetable crops are cultivated worldwide, representing 69 families and 230 genera (Kays, 2011)<sup>[31]</sup>. Leafy vegetables were the most often utilized (53% of the total), followed by vegetable fruits (15%), and vegetables with below ground edible organs comprised 17% (Dias, 2012)<sup>[32]</sup>. In Odisha province south Odisha alone is a home of 106 species of leafy vegetables out of which 78 having distinct taste and medicinal property.

### Nutritional quality and Phytoneutraceutical profile

Malnutrition is a result of faulty nutrition due to inadequate or unbalanced intake of nutrients or their impaired assimilation

or utilization which becomes the unsolved issue in developing countries. The leafy vegetables play a major hand in eradicating the malnutrition problem due to combined source of nutrients and micronutrients. Each leafy vegetable contains a unique combination of phyto-nutriceuticals (vitamins, minerals, dietary fiber and phytochemicals) which distinguishes them from other group of vegetables (Dias and Ryder, 2011) [33]. So great diversity of vegetables should be eaten to ensure that individual's diet which includes a combination of phyto-nutriceuticals to get all the health benefits. Further phytochemical and nutraceutical studies of these edible species may provide better nutritional source (Seema, 2015) [34]. Green leafy vegetables are important constituent of nutraceuticals (Gowthami *et al.*, 2016) [35] and are natural plant-based multivitamin and composed of health enhancing phytonutrients and packed with anti-oxidant vitamins such as A, C, K immune enhancing antioxidants like carotenoids and chlorophyll and cancer development reducing compound and chemo preventive like phenols, indoles. Flavonoids in addition to trace minerals, including good amounts of sulfur, potassium, calcium and iron, omega fatty acids, folate as well as vitamins and antioxidants. According to the dietician, the daily intake of vegetables should coincide with 280 g/ capita /day of vegetables from which leafy vegetable constitutes its share of 116 g/capita/day (Sahoo *et al.*, 2014) [36] but in reality, the intakes of leafy and non-leafy vegetables were less than RDI in 88 and 67% of households respectively. The consumption unit is 33g/cu/day 799 households of Odisha (Arlappa *et al.*, 2010) [37].

They contain cellulose, fibrous matter and moisture and highest source of dietary fibre, which provides necessary roughage in the diet, stimulates intestinal activities and constipation, helps to normalize bowel movements and helps in alleviating the risk of colorectal cancer. It also provides carotene which is converted to vitamin A in our body. They also help in formation of fresh blood in our body as they are rich source of iron. Potassium is crucial to heart function and blood pressure regulation and plays a key role in skeletal and smooth muscle contraction and spinach is a best source of potassium.

Green leafy vegetables are rich in a pigment called chlorophyll which helps in cleansing the blood enhance oxygen transport, balancing body pH and increases the production of red blood cells thus termed as energizing superfood for boosting cognitive and immune functions. Fresh raw greens also contain some living enzymes and digestible proteins that help in building muscle and tissue strength when consumed on regular basis. They also help to reduce inflammation, a key factor in many chronic diseases. Being useful in removing and neutralizing poisonous substances from the bloodstream, such as heavy metals, radiation, pesticides and other ingested pollutants by the vital components, they play a major role in cell membrane stability, oxygen transfer, immune response and cardiovascular maintenance.

The availability of a large diversity of vegetables year-round will help to enhance mean per capita incomes in recent years and knowledge of vegetable health benefits; will enable consumers to include a variety of health promoting phyto-nutraceuticals in their diet.

### Health benefits and medicinal significance

"Let food be your medicine and let medicine be your food" was advised by the father of medicine, Hippocrates, over two million ago. As per the World Health Organization (WHO)

report, 80% of the world population, presently use herbal medicine for some aspect of primary health care (Sujatha 2005) [38]. There is a widespread belief that the green medicines are healthier and safer than synthetic ones (Bandyopphay *et al.*, 2002; Sudha and Mathanghi, 2012) [39, 41]. Millions of people, particularly tribal and rural communities in many developing countries still collect and consumed a wide variety of wild plant resources to meet their food requirements (Balemie and Kebebew, 2006; Bharucha and Pretty, 2010) [40, 41] and use it as tonics, antioxidants, cooling, digestive, laxative, diuretic (Kamble and Jadhav, 2013) [4].

The consumption of synthetic drugs leads to hyperuricemia, diarrhoea, nausea, myositis, gastric irritation, flushing, dry skin and abnormal liver function (Speight, 1987) [42]. Leafy vegetables are characterized by high nutritional value in term of vitamins, minerals and other compounds, when properly supplemented support better health. (Sharma *et al.*, 2013) [43] which can be ultimately helpful in management of oxidative stress and age related human ailments (Gacch *et al.*, 2010) [44]. Green leafy vegetables are also rich in compounds having antidiabetic property (Keshari *et al.*, 2005) [45], anti-histaminic (Yamamura *et al.* 1998) [46] anti-carcinogenic (Rajesh Kumar *et al.*, 2002) [47] and hypo-lipidemic properties and possess preventive or curative properties against cardiovascular disease, ageing, obesity, hypertension, insomnia and ageing (Lyer *et al.*, 2012 ; Vishwakarma and Dubey, 2011) [48, 49]. Leafy greens also contain a lot of water, which helps keep you hydrated and contributes to beautiful skin and hair (Settaluri *et al.*, 2015) [50]. The uncontrolled production of oxygen derived free radicals is involved in onset of cancer, Rheumatoid arthritis and aging (Ashok Kumar CK, 2013) [28]. Green vegetables are known to be a rich source of antioxidant which neutralizes the free radicals (Moller *et al.*, 2000) [51]. Plant used for medicines contains bioactive compounds like alkaloids, flavonoids, tannins and phenolic compounds which make a plant as medicine that ultimately produce a definite physiological action on the body (Hemashenpagam *et al.*, 2009) [52]. Consumption of Green leafy vegetables particularly iron rich commodity spinach help increase iron in the diet and in the blood and ward off anemia, a critical condition of women due to inadequate iron. More than 40% of the world's blindness principally occurs due to age related cataract. Common constituent of leafy vegetables like Ascorbic acid (vitamin C), Tocopherol (Vitamin E), Vitamin A (retinol and provitamin A), Lutein and zeaxanthine, Lycopene, Folate, Riboflavin, Niacin, Molybdenum, Selenium and Zinc (De Bolle *et al.*, 1996) [53] can able to avoid eye problems.

### Expected future thrust

Due to proliferating urbanization and industrialization the land has become scarce and the biodiversity are depleting day by day due to fast loss of crop natural habitat. In this regard, the underutilized leafy vegetable face diverse challenge to make its existence. In India, various types of underutilized foods are available seasonally but are not utilized to the extent they should be in spite of their high nutritive value. Looking into the high prevalence of over and under nutrition, these underutilized foods can be explored to overcome the nutritional disorders. (Gupta and Yadav, 2016) [54]. To feed, nourish and toning up the over increasing population both by quality, it is of prime to give prioritization to not only increase the productivity of limited numbers of domestic and introduced crops of modern days but also to the nutritionally valuable and quality rich traditional vegetables.



**Table 1:** Phytonutracitcal and ethnobotanical properties of some traditional leafy vegetables of Odisha

Botanical name	Common name in ohia	English name	Family	Ecological occurrence	Season of availability	Vitamin, mineral and active chemical constituent	Medicinal properties
<i>Allium cepa</i> (herb)	Piaja saga	Spring onion	Alliaceae	Commercial crop	Rabi, Kharif	O-caffeoyl-beta-D-glucose, Anti atherosclerotic, malic acid, niacin, trans-3,5-diethyl-1,2,4-trithiolane	Antibacterial, antioxidant synergist, antiseptic, anti-tumorous, Anti-dermatitis, antihistamine (Upadhyay, 2016 and Zainab <i>et al.</i> , 2017) <sup>[55, 56]</sup>
<i>Alternanthera sessilis</i> (herb)	Madaranga	sessile joy weed	Amaranthaceae	Ponds and fields	Kharif	Proteins, fat, vitamin A, C, E, K, B <sub>9</sub> (folic acid), riboflavin, niacin, thiamine, calcium, magnesium iron, kaempferol saponins, amino acid such as arginine, leucine, isoleucine, lysine, threonine and tryptophan, peptide	Anti-oxidant, Hepato-protective, nutritive, eye health, appetizer, blood tonic (Gupta and Singh, 2012; Balachandar <i>et al.</i> , 2013) <sup>[57, 58]</sup>
<i>Amaranthus Spinousus</i> (herb)	Kanta leutia	Prickly Amaranth	Amaranthaceae	Weed in cultivated crops	Rainy, Winter	uracil, rutin, adenine 7-p coumaroyl, apigenin 4 o beta D glucopyranoside, xylofuranosyl, b-sitosterol, linoleic acid, isoamaranthanthine, gompherin, betanin, betacyanin, amaranshine, kaempferol, betalains, betaxanthin, quercetin, glucoside, hydroxyl cinnannamates, beta-D-ribofuranosyl	Obesity (Ediriweera, 2010) <sup>[59]</sup> , eczema or abscesses, dysuria (Satapathy <i>et al.</i> , 2012) <sup>[60]</sup> , burns, wounds, inflammation, indigestion (Rajasab and Mahamad, 2004) <sup>[61]</sup> , laxative, emollient, spasmolytic, diuretic (Khare, 2007) <sup>[62]</sup>
<i>Amaranthus Gangeticus</i> (herb)	Lalkhada	Chinese spinach	Amaranthaceae	Tomato and ground nut fields	Rainy Summer	glycine betaine, cyclooxygenase, diacyl galactosyl glycerol	Blood pressure (Dhanam and Elayaraj, 2014) <sup>[63]</sup> , menorrhagia, leucorrhoea, dysentery, diarrhoea, haemorrhagic colitis, cough, bronchitis (Khare, 2007) <sup>[62]</sup> , relieve headache (Manandhar, 2002) <sup>[64]</sup> , tumors and warts (Duke and Ayensu, 1985) <sup>[65]</sup>
<i>Amaranthus Oleraceous</i> (herb)	Kosala	Green amaranth	Amaranthaceae	Found as weed in waste areas	Winter	Polyphenols, tannins, flavonoids, steroids, terpenoids, saponins and betalains.	
<i>Amaranthus Viridis</i> (herb)	Leutia	slender amaranth	Amaranthaceae	Weed among cultivated crop	Summer Winter	Carotenoids, ascorbic acid, flavonoids and phenolic acids (Bagepalli <i>et al.</i> , 2009) <sup>[66]</sup>	Anti-nociceptive, anti-pyretic, Blood tonic (Bagepalli <i>et al.</i> , 2009) <sup>[66]</sup>
<i>Bacopa monnieri</i> (herb)	Brahmi sag	Indian pennywort	Scrophulariaceae	Marshy lands	Winter Rainy	bacosides, aglycone, alkaloids brahmine, nicotine, herpestine, D-mannitol, apigenin, hersaponin, monnierasides I-III, cucurbitacin and plantainoside B	Brain tonic, fever (Jeeva <i>et al.</i> , 2006) <sup>[20]</sup> , epilepsy (Satapathy <i>et al.</i> , 2012) <sup>[60]</sup> , enhance memory (Bhattacharjya and Borah, 2008) <sup>[67]</sup> , skin diseases, leprosy, epilepsy, eczema, asthma, diseases of nervous system (Manju <i>et al.</i> , 2011) <sup>[68]</sup>
<i>Basella alba</i> (climber)	poi	Malabar spinach	Basellaceae	Moist fertile and well-drained soil	Rainy winter	Calcium, vitamin A thiamine, riblofabin, niacin, betacianin vitamin C, acacetin 7,4 dimethoxy kampherol, oxalic acid, 4-methoxy isovitexin, phenolic acid like vanilla, syringic, ferulic acid.	Urinary disorders, source of Vitamin B & C (Rajasab and Mahamad, 2004) <sup>[61]</sup> , laxative, antifungal, anticonvulsant, analgesic, anemia anti-inflammatory, androgenic activities, febrifuge hemorrhages, rubefacient (Shruthi <i>et al.</i> , 2012) <sup>[74]</sup>
<i>Basella rubra</i> (climber)	Lal poi	Malabar spinach	Basellaceae	Cultivate areas in hedges	Rainy summer	Calcium, iron, vitamins A, B, and C saponins A, B, C, and D, oleanane-typetriterpenesoligoglycosides, together with betavulgaroside 1, spinacoside C, momordinsIIb, $\beta$ -carotene, $\alpha$ -carotene s 4-coumaroyl and feruloyl derivatives	Constipation, cures mouth ulcers, irregular periods, mild laxative (Shruthi <i>et al.</i> , 2012) <sup>[69]</sup>
<i>Bauhinia purpurea</i> (tree)	Barada	Butterfly tree	Fabaceae	Fields	summer	Alkaloid steroid, sterol, glycoside, saponin, flavonoid, tannin, phenolic compounds, flavonoid, protein, amino acid, fixed oil.	Antigoiter, blood purifier (Khare, 2007) <sup>[62]</sup> worm infection, cuts & wounds, antioxidant (Sahu <i>et al.</i> , 2013) <sup>[22]</sup> , constipation (Pareek and Trivedi, 2011) <sup>[70]</sup>
<i>Brassica juncea</i> (herb)	Sorisa	Mustard	Brassicaceae	Cultivated	Rabi	Erucic acid, saponins, phenols, fatty acids and amino acids. (Malan <i>et al.</i> , 2011) <sup>[71]</sup>	Analgesic, hypoglycemic, wound healing activity, nutritive, relieves joint pain (Malan <i>et al.</i> , 2011) <sup>[71]</sup>
<i>Chenopodium album</i> (herb)	Bathuaa	White goosefoot	Chenopodiaceae	Cultivated in small scale	Rabi winter	Alkaloids, carotenoids, xyloside, Limonene (23.2%), $\alpha$ -terpinyl acetate (13.7%), $\alpha$ -terpinene (12.3%) and cisascaridole (12.2%)	Anti-ulcer, anti-nociceptive and Hepato-protective, nutritive (Nigam and Paarakh, 2011; Jain and Singhai, 2012) <sup>[72, 73]</sup> , leucoderma, anthelminthic (Lal <i>et al.</i> , 2012; Satapathy <i>et al.</i> , 2012) <sup>[74, 60]</sup> , abdominal pain, gastric (Razzaq <i>et al.</i> , 2013) <sup>[75]</sup>

							seminal weakness, cardiac disorders, general debility (Jeeva <i>et al.</i> , 2006) <sup>[20]</sup>
<i>Cleome viscosa</i> (herb)	Bana sorisa	Dog mustard	Capparaceae	Crop fields, in waste lands, wet and grassy places	<i>Rabi</i>	Gallic acid, gallotannins, iridoid, saponins and terpinoid polyphenolic compounds	Anthelmintic, antiseptic, carminative, antiscorbutic, sudorific, febrifuge, and cardiac stimulant. Anti-diarrheal.
<i>Colocasia Esculenta</i> (herb)	Saaru	Elephant ear	Araceae	Commercial crop	<i>Kharif</i>	Flavonoids, $\beta$ -sitosterol, and steroids, calcium, phosphorus, and iron. Young leaves are rich in vitamin C	Styptic, stimulant (Lal <i>et al.</i> , 2012) <sup>[74]</sup> , laxative, useful in congestion of portal system (Khare, 2007) <sup>[62]</sup> , leaves rich in vitamins and minerals (Manju <i>et al.</i> , 2011) <sup>[68]</sup> .
<i>Commelina benghalensis</i> (herb)	kaniseera	Bengal day flower	Commelinaceae	Crop fields, marshy land	<i>Kharif Rabi</i>	Anthocyanin, dammarane triterpene, sterols, campesterol. Phlobatannins, carbohydrates, tannins, glycosides, volatile oils, resins, balsams, flavonoids and saponins.	Emollient, laxative and demulcent, leprosy (Lal <i>et al.</i> , 2012) <sup>[74]</sup> , suppurative sores, snake bite, swelling, burns, antioxidant (Sahu <i>et al.</i> , 2013) <sup>[68]</sup> , cancer, ulcer, skin diseases (Dhanam and Elayaraj, 2014) <sup>[63]</sup> .
<i>Cucurbita maxima</i> (climber)	Kakhharu	Squash	Cucurbitaceae	Commercial crop	Year round	Tannins, saponins, polyphenolic, alkaloids, lignans, essential oils and steroids	Anti-cancer, Anti-diabetic and Hepato-protective, nutritive (Saha <i>et al.</i> , 2011) <sup>[76]</sup> .
<i>Enydra fluctuans Lour</i> (herb)	Hidimichika	Marsh Herb	Asteraceae	Marsy and pond	<i>Kharif Rabi</i>	B-carotene. saponins, myricyl alcohol, kaurol, cholesterol, sitosterol, glycoside, sesquiterpene lactones, germacranolide, enhydrin, fluctuanin and fluctuandin, a number of diterpenoid acids and their isovalerate and angelate derivatives, stigma sterol, cholesterol, sitosterol, glycoside (Ghani, 2003) <sup>[77]</sup> .	Laxative and antibilious; cure inflammation, Leucoderma, bronchitis and biliousness; useful in skin and nervous affections; also useful in torpidity of the liver, Cooling agent. (Yusuf and Oluowle, 2009) <sup>[78]</sup> .
<i>Glinus oppositifolius</i> (herb)	Pitaa saga	Bitter cumin	Molluginaceae	Grazing field	<i>Kharif</i>	Spergulagenic acid, a saturated triterpenoid sapogenin, spergulagenic A and a tri-hydroxyl ketone.	Stomachic, aperient and antiseptic, cataplasm for dyspepsia, earache, liver diseases, anti-diabetes, malaria, joint pains, inflammation, intestinal parasites, furuncles, and wounds, abdominal pains and jaundice, dizziness
<i>Ipomoea aquatica</i> (herb)	Kalama	Swamp morning glory	Convolvulaceae	Ponds and marshy lands	Whole year	Protein, vitamin B <sub>2</sub> , Nortropane alkaloids, calystegines B <sub>1</sub> ; phenolic compounds N-cis-Feruloyltyramine, N-trans-Feruloyltyramine, 3 $\alpha$ ,7 $\beta$ -O-D-di glycopyranosyl-dihydroquercetin and Isochlorogenic acid a, b and c., nicotinic acid, riboflavin, vitamin E, essential amino acids, leucine, lysine and threonine, potassium, calcium, sodium phosphorus, magnesium, copper, zinc, iron and manganese	Blood purifier and cure gonorrhea. Rheumatism, inflammations, antioxidant (Sahu <i>et al.</i> , 2013) <sup>[68]</sup> , purgative (Lal <i>et al.</i> , 2012) <sup>[74]</sup> , gonorrhoea, blood purifier (Manju <i>et al.</i> , 2011) <sup>[68]</sup> .
<i>Largenaria siceria</i> (climber)	Laau	Bottle gourd	Cucurbitaceae	Commercial crop	Rainy	sterols, terpinoid, flavonoids, and saponins Cucurbitacin, fibres, and polyphenol	Jaundice, diabetes, ulcer, piles, colitis, insanity, hypertension, congestive cardiac failure (CCF), and skin diseases (Prajapati <i>et al.</i> , 2010) <sup>[79]</sup> .
<i>Leucas aspera</i> (herb)	Gayasa	Thumbai	Laminaceae	Dry open sandy soil	Rainy	5,7-dihydroxy-2-[14-methoxy-15-propyl phenyl]-4H-chromen-4-one (leucasin), (Goyal <i>et al.</i> , 2008) <sup>[80]</sup> fatty acid esters, fatty acid amide, triterpene, diterpene alcohols and phytol (Anandan <i>et al.</i> , 2012) <sup>[81]</sup> .	Ear ache, sore, snake bite, jaundice, antioxidant (Sahu <i>et al.</i> , 2013) <sup>[68]</sup> , gastric trouble (Satapathy <i>et al.</i> , 2012) <sup>[60]</sup> , dyspepsia, verminosis (Dhanam and Elayaraj, 2014) <sup>[63]</sup> , anorexia dyspepsia, helminthic manifestation, fever respiratory and skin diseases (Khare, 2007) <sup>[62]</sup> .
<i>Marselia minuta</i> (herb)	Sunsunia	Four leaf clover	Marsilaceae	Moist, wet soil, in water	Rainy winter	Saponin, flavonoid, phenol, quinones, tanins, terpenoids, coumarins, anthroquinones and alkaloids	Bronchitis, psychopathy, ophthalmia, diarrhoea, leprosy, skin disease, fever, sedation, haemorrhoids, dyspepsia, insomnia, diuretic, anti-inflammatory, (Dhanam and Elayaraj, 2014) <sup>[63]</sup> .
<i>Momordica Charantia</i> (climber)	Kalara	Bitter gourd	Cucurbitaceae	Commercial crop	Year round	Calcium, magnesium, potassium, phosphorus, iron vitamins, Thiamine, Riboflavin, Niacin, vit.B <sub>6</sub> , Folate (Dhalla <i>et al.</i> , 1981) <sup>[82]</sup> .	Cholera, bronchitis, anemia, blood diseases, ulcer, diarrhea, dysentery, gonorrhea rheumatism, gout, anti-diabetic colic, disease of liver and spleen, cancer and diabetes (Gupta and Prakash, 2011) <sup>[83]</sup> .
<i>Mentha sativa</i>	Pudina	Mint	Laminaceae	Marshy land	Rainy	1, 8-cineole, carvone, limonene, linalool, linalyl acetate,	Flatulence, functional gastrointestinal and gallbladder disorders

(herb)				Sandy soil	Winter	menthol, menthone, menthyl acetate, and piperitenone oxide.	(Khare, 2007) <sup>[62]</sup> .
<i>Moringa Oleifera</i> (tree)	Sajana	Drumstick	Rutaceae	Commercial crop	Year round	4-(4'- <i>O</i> -acetyl- $\alpha$ -L-rhamnopyranosyloxy) benzylisothiocyanate, 4-( $\alpha$ -L-rhamnopyranosyloxy) benzyl isothiocyanate, niazimicin, Pterygosperrin, benzyl isothiocyanate and 4-( $\alpha$ -L-rhamnopyranosyloxy) benzyl glucosinolate, carotenoids (including $\beta$ -carotene or provitamin A)	Anti-hyperlipidemia, Anti-cancer, Anti-microbial, Anti-oxidant. Nutritive laxative, Relieves joint pain, maintains eye health, blood tonic (Goyal <i>et al.</i> , 2007) <sup>[84]</sup> .
<i>Oxalis corniculata</i> (herb)	Ambilti	Indian sorrel	Oxalidaceae	Damp shady places, roadsides, plantations	Rainy winter	Tartaric acid and citric acids, calcium oxalate, flavones (acacetin and 7,4'-diOMe apigenin), glycoflavones (4'-OMe vitexin, 4'-OMe iso-vitexin and 3',4'-diOMe orientin), flavonols (3',4'-diOMe quercetin) and phenolic acids such as p-hydroxyl benzoic, vanillic and syringic acids, oxalate, 6-C-glucosyl luteolin (isoorientin), 6-C-glucosylapigenin (isovitexin) and isovitexin 7-methylether (sertisin) (Merugu <i>et al.</i> , 2015) <sup>[85]</sup>	Anorexia (Ediriweera, 2007) <sup>[59]</sup> , anemia, tympanitis, dyspepsia, dysentery and piles (Lal <i>et al.</i> , 2012; Satapathy <i>et al.</i> , 2012) <sup>[74, 60]</sup> , appetizer, cough, jaundice, rickets, scurvy (Kumari and Kumar, 2000) <sup>[86]</sup>
<i>Paederia foetida</i> (herb)	Pasaruni	Chinese fever vine	Rubiaceae	Under water, disturbed areas	Year round	Linalool, hentriacotan, hentriacontanol, cerylalcohol, benzofuran, sulphur containing compounds, dimethyl sulphide and dimethyl trisulphide, ursolic acid, sitosterol, stigmasterol, camestrol, fatty acid, nonionic acid, capric acid, lauric acid, myristic, arachnidic and palmitic, vitamin C	Hepatoprotective, Antitussive, Antioxidant, Antispasmodic, Anthelmintic, immunity enhancer, stimulate central nervous system, rheumatoid arthritis. Abdominal pain.
<i>Polygonum plebejum</i> (herb)	Muthi saga	Common knotweed	Polygonaceae	Puddles, ditches, rice fields	winter	Steroid, tannin. oleanolic acid, betulinic acid, epi-friedelanol, beta-sitosterol, flavonoids- quercetin, quercetin-3-arabinoside and quercetin-3-rutinoside.	Haematuria dysuria, piles dermatitis (Ediriweera, 2007) <sup>[59]</sup> cough, dysentery, lactation, bowel complaint, Gastric trouble (Kumari and Kumar, 2000) <sup>[86]</sup>
<i>Raphanus sativus L.</i> (herb)	Mulaa saga	radish	Brassicaceae	Cultivated fields	winter	Phytol (65.3–69.7%), hexadecanoic acid (2.5–14.3%), methyl linolenate (2.1–11.1%) and (Z)-3-hexen-1-ol (0.7–6.9%), 5-(methylthio)-4-pentenitrile (0.3–2.2%), 4-(methylthio) butyl isothiocyanate (0.3–1.7%), 2-phenylethyl isothiocyanate (0.4%), 4-(methylthio)-3-butenyl isothiocyanate, 4-methylpentyl isothiocyanate, benzyl isothiocyanate and benzenepropanenitrile, calcium, iron and ascorbic acid.	Gastrointestinal, biliary, hepatic, urinary and respiratory disorders, and hypertension, laxative
<i>Spinacia Oleracea</i> (herb)	Paalanga	Spinach	Chenopodiaceae	Cultivated field	winter	Tannins, saponins, polyphenolics, alkaloids, lignans, essential oils and steroids (Garg <i>et al.</i> , 2010) <sup>[87]</sup> iron and calcium, vitamin A, C and K and folic acid. carotenoids Beta-Carotene and Lutein, bioflavonoid Quercetin	Carminative; febrifuge; hypoglycaemic, laxative., lower heart diseases stroke and cancer. regulate high blood pressure, osteoporosis, arthritis, improve brain function and may reduce age-related cognitive problems, anemia, retinal disorder.
<i>Trigonella foenum-graecum</i> (herb)	Methi	Fenugreek	Fabaceae	Cultivated	winter	Amino acid, fatty acid, vitamins, saponins, folic acid, disogenin, gitogenin, Quercetin, saponins, stearic acid, polysaccharides neogitogenin, homorientinsaponaretin, neogitogenin, and trigonin, 4, 5[delta]-cadinene (27.6%), [alpha]-cadinol, palmitic acid, linoleic acid oleic acid, flavonoids, and hexanal, 2-methyl-2-butenal, 3-octen-2-one, trigonelline, choline, galactomannan, (Toppo <i>et al.</i> , 2009) <sup>[88]</sup>	Anti-diabetic, anti-cancer, anti-inflammatory, anti-oxidant, Nutritive, blood tonic (Toppo <i>et al.</i> , 2009) <sup>[88]</sup>

## Conclusion

Biodiversity, a human managed natural ecosystem consisting of habitat of species diversity and species richness. In order to create more robust and resilient production systems, we have to depend upon biodiversity. Underutilized leafy vegetables can strength our nutritional security and commercial cultivation of these lesser known underutilized greens will not only help in improving the economic and nutritional condition of people but also help in conserving the valuable and endangered bio diversity. it may be the vital source of income in the modern society for the small and marginal category, thus alleviating their economic condition and ensuring health and nutritional security of the farming community. Though India have ideal agro-climatic condition to raise number of leafy vegetables, more greens found in wild and unexplored. Knowledge of wild leafy vegetables may be lost in the near future, unless efforts are made to educate younger generations about their importance. These traditional greens having rich in bioactive compounds can play a role of future medicine. India is a storehouse of large number of unexplored, indigenous vegetables which are competing to become major crops in years to come. Exploitation and wider use of these underutilized crops can become a solution to the social problems like food health and nutritional security, poverty and unemployment. Although, 175 major and minor vegetable crops are grown in India including 82 leafy vegetables, there is a challenge to achieve the target of 160 million tons of vegetables to fulfil the recommended requirement by 2020. The rich leafy flora should be restored from extinct by germplasm conservation and further multiplication of the true through different breeding methods and R&D managements chains. Significant research, breeding and development efforts are needed for a range of promising crops to convert existing local landraces into competitive varieties with wide adaptation and promising commercial potential. Underutilized crops can play a major role in a more diversified and sustainable food production system. Access to genetic diversity of these selected crops is a pre-condition for success. Traditional vegetables are becoming an increasingly attractive food group for the wealthier segments of the population and are slowly moving out of the underutilized category into the commercial mainstream.

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