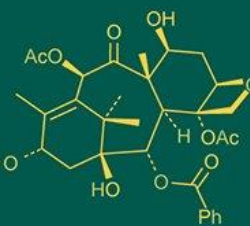
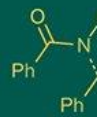
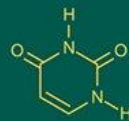
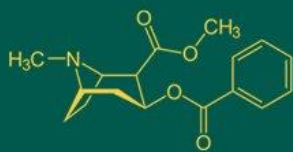


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(11): 454-458
www.biochemjournal.com
Received: 01-09-2025
Accepted: 05-10-2025

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Utilization of indigenous leafy vegetables as nutraceuticals by the tribal community of Jorhat district

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DOI: <https://www.doi.org/10.33545/26174693.2025.v9.i11Sf.6268>

Abstract

A survey was carried out throughout the entire Jorhat district. During the survey fifty numbers of peoples were contacted, they were asked about the traditional belief regarding the consumption of indigenous leafy vegetables and their responses were recorded. Based on the responses and knowledge of the local community thirty one numbers of plants were collected from different places of Jorhat district and identified by taxonomist. The research study was aimed to find out the economic, nutritional and medicinal values of thirty one number weedy plants utilized traditionally as leafy vegetables by the Assamese tribal communities in various places of Jorhat district. It was targeted to know the economic value with respect to their use as vegetables for nutrients and other medicinal benefits. After the investigation it was known that 31 species of 24 families of herbal weeds were used for vegetable purpose, to fulfill nutritional and medicinal requirement of the local community from the generation after generation. These herbal indigenous weedy plants were different from each other. They were found economically important due to their utilization as vegetables, as medicines and for nutrients. The traditional knowledge about these indigenous weedy plants as leafy vegetables for nutrient and medicine is unknown or less known to the world.

Keywords: Fat, weedy plants, indigenous knowledge, tender leaf, nutraceuticals, chemicals

Introduction

Human being is utilizing the plants from the beginning of civilization as food and to treat different types of diseases and disorders. The relationship of man and plants since ancient times help human being to know about the values of the plants as vegetable for nutrients and as medicines for treatment of different types of ailments. Some plant may be useful in one place as vegetables, nutrient sources, feed, medicine and fibres. But the same plants may be considered as weed in other places. Thus, plant species couldn't be considered as weed under all circumstances (Ullah *et. al.*, 2006) ^[1]. Assam, an unique places of biodiversity on the earth having different climatic zones with different plant species. The traditional knowledge of tribal communities regarding the nutrients and medicinal values forms the basis of modern allopathic medicines and food processing industry across the world. The societies have unique cultural practices which vary from country to country, region to region, village to villages and even in communities. This knowledge is termed as indigenous knowledge (Nagnur *et. al.*, 2006) ^[2].

Indigenous Leafy vegetables have a important role in the diet of Assamese society, since these leafy vegetables traditional used as herbal medicine, sources of nutrient, low cost and easy accessibility. Moreover, These wild leafy vegetables are considered as a important sources of vitamins, carbohydrates, phytochemicals, minerals, fibres and low fat by the local people. Many scientific investigations have been conducted regarding the nutritional values of these vegetables. Many reports have been published throughout the world about wrong identification of herbs, consumption of poisonous herbs that can cause damage to the vital organs of human beings. The exotic species of vegetables unable to survive in harsh climatic and poor soil conditions in many parts of rural places. Of course, lots of indigenous plant species are available to overcome this situation. These wild leafy vegetables have low agricultural potential; still have valuable contribution towards food security during scarce

flood periods and gives dietary supplements to the main diet.

The north eastern region comes under Eastern Himalayas of India is a world biodiversity hot spot and have a great reservoir of plant genetic resources. There is almost 3895 species of flowering plants available in Assam (Gopichand, 2008) [3]. Out of these vast plant diversity huge number of traditional plant species and their wild forms have contribution these dietary vegetables of the tribal communities. These vegetables provides sufficient nutrients, novel nutraceuticals and herbal medicines for the people. Wild leafy vegetables have formed a year round food security for women, poor household and children of tribal communities. These tribal people depend on consumption of wild leafy vegetables to meet their daily requirement of vitamins, minerals, protective chemicals.

The traditional knowledge, utilization and beliefs of the people will help to determine the nutritional value of these wild leafy vegetables by their many uses like medicines, foods or feeds. The availability and distribution of these leafy vegetables are determined by the agro-ecological factors. The cultural beliefs, dietary habits, indigenous knowledge influence the identification, collection and production, preference, part/s used, processing and preservation method, culinary practices, pattern of use. The traditional knowledge, dietary habits, and beliefs are associated with the nutritional, anti-nutritional and medicinal values of these wild plant species.

Now a days the exploitation of many species of these plants by the tribal population is restricted in their centre of origin. Among them some of the wild leafy vegetables have been become popular the urban market due to their acceptance among the urban population. The value additions of the local products provide an opportunity to safe the marginal land and to protect the biodiversity available in that land. The valorizations of local products improve the economic condition of the local people and strengthen the food basket for more diversified diet. Since the people of these regions are associated with these vast natural flora and fauna and used these wild leafy as vegetables so, the occurrence of malnutrition diseases like anemia, night-blindness and goiter which occurs due lack of vitamins and micronutrients are less in these locality as compared to the national average.

Thus, traditional green leafy vegetables are considered as the plants whose leaves are socially accepted, consumed for various purposes like as food, for nutritional requirement and for medicinal purposes and also used as food additives. Green leafy vegetables play an important role in the Assamese diet, which is due to their influence as traditional herbal medicine, easy accessibility and low cost. Further, green leaves are considered as a main source of vitamins, minerals and fibre for local consumers. The use of wild plants as leafy vegetables is very common in Assam. Some of these species are also very popular but some species are less important. In Assam they appear as uncultivated and semi cultivated crops or weedy and wild plants, with ecological, social and cultural values, playing a significant role in the daily food habit and to fulfill the nutritional requirement of local people mainly in the rural. However, there is no significant scientific basis or reports in the

modern literature regarding its nutritional value and traditional knowledge. That is why the present study has been designed to survey out the use of these indigenous leafy vegetables as a source of nutrient and herbal medicine by the people of Jorhat district of Assam.

Materials and Methods

The present study was conducted throughout the different places of Jorhat district of Assam, India. This North Easter Region of India has been identified as one of the important hotspots of the global biodiversity (W C M C, 2002) [5]. The indigenous knowledge and traditional uses of these plants are collected with the help of questionnaire. Local people like house wives and older people of these areas were interviewed during this collection of information about the vegetables and other uses of these plants (Choudhury *et al.*, 2017) [6]. The local uses of these specimens were also confirmed by elderly local people who having knowledge of these local herbs. These wild plant species were collected for evaluation, identification and confirmed by taxonomist.

Based on the popularity of use by the people of Jorhat district, thirty one indigenous plant materials viz. *Leucas longifolia*, *Bacopa monnieri*, *Enhydra Fluctuans*, *Amaranthus spinosus*, *Eryngium foetidum*, *Pteridium aquilinum*, *Hydrocotyl rotundifolia*, *Amaranthus viridis*, *Paederia foetida*, *Alternanthera sessilis*, *Eclipta alba*, *Paederia foetida*, *Talinum triangularae*, *Polygonum chinense*, *Oxalis corniculata*, *Paederia foetida*, *Oldenlandia corymbosa*, *Chrysopagon coroneriam*, *Malva sylvestris*, *Basella rubra*, *Trigonella foenum-graecum*, *Stellaria media*, *Chenopodium album*, *Basella alba*, *Oxalllis acetosella*, *Centalla asiatica*, *Ponzolzia indica*, *Portulaca oleraceae*, *Drymaria cordata*, *Gynandropis gynandra*, *Clerodendrum colebrookianum* and *Pogostemon benghalensis* were collected from different places of Jorhat district, Assam, India. The collected plants materials were cultivated in soil filled pot in the Department of Agricultural Biochemistry, Assam Agricultural University, Jorhat-13 for further investigation.

Results and Discussion

The findings of investigation of wild green leafy vegetables for nutraceuticals, vegetables and herbal medicines are presented in the Table 1.

The wild leafy vegetables present in the field as uncultivated weeds and cause heavy damages to the crops. But these uncultivated weeds have many important uses in our daily life. They have positive effect rather than negative effect. The most important positive effect these of wild leafy vegetables is that they possess nutrients as well as they have therapeutic properties. The native people used these wild leafy vegetables as a source of nutrient as well as phytochemicals for curing various health problems (Sarma *et al.*, 2006) [9]. Plants of 24 different families were collected from different location of Jorhat district, Assam and identified along with their folk uses. The collected data of wild leafy vegetables along with local names, family, botanical names, ITKs, part used as vegetables, nutraceuticals are presented in table 1.

Table 1: Nutraceuticals and ITKs of indigenous leafy vegetables of Jorhat district of Assam

Sl. No.	Local name	English name	Botanical name	Family	Part used as nutrient	Part used as medicines
1	Brahmi	Bacopa	<i>Bacopa monnieri</i> (L.) Wettst.	Scrophulariaceae	Tender leaf and stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, Na, P, Fe	Improve memory, cure diabetes, improve digestion, eye power, cure itching, clear bowel
2	Dorun	Dhudani	<i>Leucas longifolia</i> Benth.	Lamiaceae	Tender leaf and stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, Na, P, Fe	Improve digestion, cure tonsil, cure pharngitis, cure flow disease, clear bowel, cure diabetes
3	Helosi sak	Water cress	<i>Enhydra fluctuans</i> DC.	Asteraceae	Tender leaf and stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, Na, K, N	Cure jaundice, improve digestion, clear bowel, cure diabetes
4	Mandhanian	Long coriander	<i>Eryngium foetidum</i> L.	Apiaceae	Tender leaf, Mature leaf as spice, vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, Na, P, Mn	Improve digestion, flatulence, clear bowel, cure diabetes
5	Hatikhutor	Spiny amaranth	<i>Amaranthus spinosus</i> L.	Amaranthaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, Mn, Na, P	Cure jaundice, stomach pain, clear bowel, cure diabetes
6	Dhekia	Bracken fern	<i>Pteridium aquilinum</i> (L.) Kuhn.	Dennstaedtiaceae	Fiddlehead greens as vegetables for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, N, P, Cu, Ca	Improve bone formation, help in digestion, clear bowel, cure diabetes
7	Khotora	Slender amaranth	<i>Amaranthus viridis</i> L.	Amaranthaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, Na, P, Ca	Improve digestion, clear bowel, cure diabetes
8	Saru Manimoni	Indian pennywort	<i>Hydrocotyl rotundifolia</i> Lam.	Apiaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, Na, Ca, K, Mn	Improve digestion, cure jaundice, cure liver disorder, cure diarrhea, clear bowel, cure diabetes
9	Matikandori	Sessile Joywood	<i>Alternanthera sessilis</i> (L.) R.Br.ex DC.	Amaranthaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, Fe, Na, K, P	Increase blood, help in wound healing, cooling brain, clear bowel, cure diabetes
10	Bhedailata	Skunk vine	<i>Paederia foetida</i> L.	Rubiaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, P, Na, Ca, Fe	Improve digestion, cure anemia, cure diarrhea, cure ulcers, clear bowel, cure diabetes
11	Keheraj	False Daisy	<i>Eclipta alba</i> L.	Asteraceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, Mn, Na, Ca	Cure jaundice, cure teeth diseases, clear bowel, cure diabetes
12	Masundori	Coriander scented	<i>Houttuynia cordata</i> Thunb.	Saururaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, P, Na, Ca, Mn, Fe	Improve digestion, cure diarrhea, cure dysentery, clear bowel, cure diabetes
13	Pirali paleng	Water leaf	<i>Talinum triangularae</i> (Jacq.) Wild.	Portulacaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, K, Na, P, Mn	Clear bowel, source of vitamin, cure diabetes
14	Madhuholang	Chinese Knotweed	<i>Polygonum chinense</i> L.	Polygonaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, N, P, Na, Mn	Cure poxes, source of vitamin, clear bowel, cure diabetes
15	SaruTengesi	Creeping woodsorrel	<i>Oxalis corniculata</i> L.	Oxalidaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, Ca, Fe, P, Na	Purify blood, cure dysentery, clear bowel, cure diabetes
16	Bonjaluk	Francais	<i>Oldenlandia diffusa</i> (Wild.) Roxb.	Rubiaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, P, Na, Ca, Fe	Cure liver diseases, cure flatulence, cure jaundice, cure eye swelling, clear bowel, cure diabetes
17	Laffa	Common mallow	<i>Malva sylvestris</i> L.	Malvaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, N, P, Ca, Fe	Cure throat problem, clear bowel, cure diabetes, improve gut ecology
18	Baburi	Crown daisy	<i>Chrysopogon coronarium</i> L.	Poaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-	Source of vitamin, clear bowel, cure diabetes, improve gut ecology

					chemicals, Na, P, Fe, Mn	
19	Methi	Fenugreek	<i>Trigonella foenum-graecum</i> L.	Fabaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, P, Na, Ca, Fe	Kill worm, cure diabetes, improve digestion, clear bowel, improve gut ecology
20	Puroi (red)	Malabar spinach	<i>Basella rubra</i> L.	Basellaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, P, Ca, Na, Mn	Cure low pressure, cure burning, clear bowel, cure diabetes
21	Jilmil	Fathen	<i>Chenopodium album</i> L.	Chenopodiaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, P, Na, Ca, Fe, Mn	Increase blood, clear bowel, improve gut ecology, cure diabetes
22	Morolia sak	Common chickweed	<i>Stellaria media</i> (L.) Vill.	Caryophyllaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, P, Na, Ca, Fe, Mn	Cure dysentery, clear bowel, cure diabetes, improve gut ecology
23	Puroi (green)	Malabar spinach	<i>Basella alba</i> L.	Basellaceae`	Tender leaf along with tender stem as vegetables for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, P, Na, Ca, Zn, Mn	Cure low pressure, cure burning, clear bowel, cure diabetes, improve gut ecology
24	Bor Manimoni	Indian pennywort	<i>Centalla asiatica</i> (L.)Urb.	Mackinlayaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, P, Na, Fe, Mn	Cure jaundice, cure appendix, purify blood, clear bowel, cure diabetes
25	Bor tangeshi	Common woodsorrel	<i>Oxalllis acetosella</i> L.	Oxalidaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, N, Na, Ca, Fe, Mn	Cure allergy, clear bowel, purify blood, improve gut ecology, cure diabetes
26	Malbhog Khotura	Purselane	<i>Portulaca oleraceae</i> L.	Portulacaceae	Tender leaf along with tender stem as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, N, Ca, Fe, Mn	Purify blood, improve digestion, clear bowel, cure diabetes
27	Bharali Bhukoya	Graceful pouzolzbush	<i>Ponzolzia indica</i> L.	Urticaceae	Tender leaf as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, N, P, K, Ca, Fe	Cure ulcers, cure skin diseases, clear bowel, cure diabetes, improve gut ecology
28	Laijabori	Chickweed	<i>Drymaria cordata</i> Wild Ex.SCHULT <i>Gynandropis gynandra</i> , <i>Clerodendrum colebrookianum</i> , <i>Pogostemon benghalensis</i>	Caryophyllaceae	Tender leaf as vegetable for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, N, P, K, Fe	Increase blood, clear bowel, cure diabetes, improve gut ecology
29	Bhutmoola	African Spider Flower	<i>Gynandropis gynandra</i> (L.) Briq.	Capparidaceae	Tender leaf as vegetables for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, Ca, Na, Fe, Cu	Cure dysentery, improve digestion, clear bowel, cure diabetes, improve gut ecology
30	Nephaphu	East Indian Glory Bower	<i>Clerodendrum colebrookianum</i> L.	Chenopodiaceae	Tender leaf as vegetables for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, P, K, Fe, Mn	Improve digestion, cure dysentery, clear bowel, cure diabetes, improve gut ecology
31	Sh-ukloti	Pathchouli	<i>Pogostemon benghalensis</i> (Burm.f.) Kuntze	Lamiaceae	Tender leaf as vegetables for fibre, low sugar, low fat, high vitamins, high phyto-chemicals, N, P, Na, Fe	Cure injury, create thirsty tendency, clear bowel, cure diabetes, improve gut ecology

The wild leafy vegetables supplies nutrient and phytochemicals what hich are used for treatment of various types of diseases and disorders including cancers, diabetes, heart disease, liver related ailments and other age diseases.. Most of the local people of Jorhat district utilized these plant food for their nutritional and medicinal requirement. These wild vegetables contain some essential phytochemicals as per the report of local inhabitants which can improve health problem and the same was confirmed by Choudhury *et al.* (Choudhury *et al.*, 2017; Choudhury *et al.*, 2018) [6, 7]. By scientific investigation. As per the reports of Choudhry *et al.* (Choudhury *et al.*, 2017; Choudhury *et al.*, 2018) [6, 7] these wild leafy vegetables contain huge minerals, vitamins and phytochemicals which can fulfill the requirement of nutrient as well as medicines. Younger generation slowly start to forget the indigenous knowledge of these plants due to

ignorance and weak communication. Old people still possess the knowledge of these wild resources (Zhang, 1996; Sarma *et al.*, 2006) [8, 9] Preservation of these wild plants resources of this locality are very much essential, if don't preserve then many wild plant species will extinct.

The wild plant species which are investigated and identified during the investigation will give a basic idea and primary knowledge to the world community for scientific investigation. This survey generates awareness regarding these unknown, ignored, traditionally important, uncultivable agricultural weeds utilized by rural tribal people of Jorhat district. As per the report of Sarma *et al.* (2006) [9] these wild plant species used as vegetables are the important sources of medicines for treatment various diseases.

The traditional knowledge about the utilization of these vegetables for nutrient, traditional techniques for treatment of different diseases and knowledge of various ethnic communities of this localities about these leafy vegetables available in of north-eastern part of India give opportunities for agricultural diversification and intensification (Zhang, 1996)^[8]. The present knowledge regarding the utilization of these wild vegetables as food will give various information about nutraceuticals as well as herbal medicines used for treatment of different tribal diseases (Wallace *et al.*, 1997)^[10]. This will emphasize on the utilization of these wild plants as a component of agriculture sector and contribute for the economic development of the region.

But there is some problem regarding the creation of awareness for proper collection techniques of different species found throughout the states. Awareness is essential about the importance of these plants among the rural and urban people. They should be guided and provide training for cultivation and marketing so that they can enhance their level of income. Moreover, the authors feel that more intensive studies will provide more useful information about phytochemists, pharmacologists etc. for screening of the individual plant species and rapid utilization for development of useful drugs. These medicinal plant species used by the villagers should be properly evaluated to know their safe utilization and efficacy (Ibrar *et al.*, 2003; Sarma *et al.*, 2008)^[11, 12]. Proper attention should be given for their exploitation and utilization, preservation, conservation, propagation, domestication and scientific investigation for identification of bio-active components for safe utilization for treatment of diseases and disorders.

Conclusion

It is seen that the investigated wild leafy vegetables are used by the local tribes as vegetables to fulfill the requirement of nutrient as well as medicine of the people of Jorhat district. Jorhat district is very rich in flora; still a large number of species if remaining unexplored. Therefore, if proper attention is given it may lead to the invention of some new nutraceuticals, drugs and medicines in the near future.

Acknowledgements

The Authors express their gratitude to the villagers, housewives and elderly people of that community of Jorhat district for their immense help and co-operation during the survey.

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