

## **Indigenous Vegetables for Food and Nutritional Security in Andaman and Nicobar Islands, India**

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### **Abstract**

Indigenous vegetables have enormous potential to contribute in food and nutritional security in tribal or geographical challenged regions like Andaman and Nicobar Islands, India. The present paper reviews the work on indigenous vegetables in Andaman and Nicobar Islands for their potential in sourcing the dietary micronutrients and natural antioxidants for poor and marginal communities. These are highly preferred and frequently consumed vegetables by tribal and rural communities as compared to the exotic vegetables. Their easy accessibility, cost effectiveness, low pesticide or chemical uses and abundance in and around habitat make them preferred choice for the rural and tribal population. They are rich in micronutrients iron, calcium, zinc and copper and phosphorus and antioxidants like phenolics, carotenoids, ascorbic acid, anthocyanin, flavonoids and tannins. The survey of 120 respondents from 15 villages in all the three districts of the islands revealed the role of indigenous vegetables in traditional diets of indigenous tribes and rural communities in islands. However, respondents stressed the need to address the issues such as conservation, improvement, marketing and nutritive profiles of indigenous vegetables. For this a number of strategies are suggested in the paper, some of them are under way through collaborative network for research and development and extension.

**Keywords:** Indigenous vegetables, Micronutrients, Hidden hunger, Tribals, Antioxidants.

## 1. Introduction

Vegetables are 'protective foods' and contribute in essential micronutrients and vitamins of daily diet. They are rich in phytochemicals which are associated with lowering the risk of cardiovascular, digestive, colon cancer, anaemia, fatigue, blindness and other immunity associated diseases. According to *The World Health Report 2002* low fruit and vegetable intake is estimated to cause about 31% of ischaemic heart disease and 11% of stroke worldwide (WHO 2002). Overall it is estimated that up to 2.7 million lives could potentially be saved each year if fruit and vegetable consumption was sufficiently increased. Indigenous vegetables are region specific, limited acceptance, part of subsistence production system, no established market and never undergone for any breeding program (Singh and Singh, 2012). Further, they are native to or originating from a particular region or and naturalized or evolved from introduced materials over a period of time. They are abundant, easily accessible, locally adaptable, cost effective and acceptable in custom and traditions of tribal and settler communities (FAO, 1988). Many of them are rich in 'protective elements' than exotic counterparts and also have anti-bacterial, anti-viral, anti-inflammatory, antithrombotic, vasodilatory actions and antioxidant activities (Olembo et al., 1995; WHO, 2003). The India is very diverse in climate, agro-ecologies, tribes, topography, altitudes and agri-biodiversity where promotion of local indigenous vegetables fit well in the concepts of 'fresh is better' and also 'variety is important' and this can reduce the burden on government account for targeting the malnutrition. In this line, the indigenous vegetables have significant role in food and nutritional needs of the tribes and rural communities (Singh et al. 2010). However, systematic information was required for promotion of indigenous vegetables of islands for ensuring sustainable food and nutritional security to marginal communities.

## 2. Study Locale

The study locale Andaman and Nicobar Islands is constituted of 572 islands in Bay of Bengal in Indian Ocean with geographical area of around 8249 sq km area. It stretches between 6° N to 14° N latitude on 92° E to 94°E longitudes. The islands have typical tropical maritime climatic situation with average annual rainfall of 3100 mm, temperature ranges from 20 to 32°C and high relative humidity (70-92%). These islands are rich in floral biodiversity which represents flora of both North-East India and Indonesia-Myanmar regions (Balakrishnan and Ellis 1996). The islands have six indigenous tribes (Nicobari, Jarawa, Onge, Shompen, Sentinel and Great Andamanese) and more than seven settler communities (Bengali, Tamil, Malayali, Telugu, Oriya, North Indian and others) (Majumdar, 1975). Over the years, this favoured amalgamation and evolution of diverse food cultures which helped in identification of

new local food resources in this small archipelago. The surveys were conducted and information was collected from 120 respondents of 15 different villages in all the three districts of Islands using a pre-tested questionnaire. The identified species were validated with the help of Regional Station of Botanical Survey of India, Port Blair.

### 3. Results and Discussion

#### 3.1 Diversity of indigenous vegetables

During survey, 52 indigenous vegetables were identified from the islands which showed diversity for habitat, edible portion, food value and health perception (Table 1). They were dominant equally by herbs and trees (35.7% each) followed by vines, shrubs, climbers and plam. Most of them were perennial (69.0%), partially domesticated (89.4%) and collected from forest or farmlands (85.7%). Only six traditional vegetables got commercial cultivation status while 26 were in transition phase from wild to homegarden or cultivated habitat. Four tree species *Artocarpus heterophyllus*, *A. incise*, *Murraya koenigii* and *Tamarindus indica* were prevalent in homegardens. The observations are in conformity with reports of Abraham et al. (2008), Pandey et al. (2006) and Singh et al. (2012). Respondents gave high score for their tolerance to biotic and abiotic stresses, local adaptability and richness in protein (Singh et al. 2011).

#### 3.2 Edible portion and culinary uses

The survey revealed predominance of multi-part use of traditional vegetables i.e. two parts and more than two parts and only few were used for single part. Their leaves, tender stem, roots, flowers, unripe fruits, spikes and immature seeds are consumed by tribes and rural settlers by preparing various cuisines. Leaf was most common edible part in traditional vegetables (42%). The findings are in conformity with reports from similar demographic regions of North-East India (Baruah and Bora, 2009). Traditional vegetables are consumed after minimal processing viz. cleaning, washing, boiling, frying, grinding, mixing and drying. The delicious dishes like chutney, fired items, pickles, boiled vegetables, roasted tender stem and mix vegetables. *E. foetidum*, *M. oleifera*, *H. sabdariffa* and *Piper serpentum* are also used to enhance taste and flavour of dietary preparations. They also used in making of household snacks like *pakora*, soup, *muruku*, *vada* and *maththi*. Immature fruits of perennial trees also used for culinary preparations but their less popularity was primarily due to cumbersome processes of product preparation and lack of availability (Singh and Singh, 2012). During survey, differences were observed among local communities for preference of individual traditional vegetable which might be due to differences in dietary habits and associated food traditions (Majumdar, 1975; Singh et al., 2012).

**Table 1:** List of selected indigenous vegetables of Andaman and Nicobar Islands.

Local name	Botanical name	Family	Local name	Botanical name	Family
Khari Bhaji	<i>Acrostichum aureum</i> L.	Pteridaceae	Kakrol	<i>Momordica cochinchinensis</i> (Lour.) Spreng.	Cucurbitaceae
Madrashi bhaji	<i>Alternanthera philoxeroides</i> Griseb	Amaranthaceae	Kakrol	<i>Momordica dioica</i> Roxb.	Cucurbitaceae
Marsha	<i>Amaranthus blitum</i> A. <i>lividus</i> , A. <i>viridis</i>	Amaranthaceae	Sahjana	<i>Moringa oleifera</i> Lam.	Moringaceae
Bread fruit	<i>Artocarpus heterophyllus</i> Lam., A. <i>incisa</i> L.	Moraceae	Curry leaf	<i>Murraya koenigii</i> Spreng.	Rutaceae
Neem	<i>Azadirachta indica</i> Juss.	Meliaceae	Plantain	<i>Musa</i> sp.	Musaceae
Bamboo	<i>Bambusa</i> spp.	Poaceae	Sapla	<i>Nymphaea nouchali</i> L.	Nymphaeaceae
Poi	<i>Basella alba</i> , B. <i>rubra</i> L.	Basellaceae	Sword fruits	<i>Oroxylum indicum</i> Vent.	Bignoniaceae
Kachnar	<i>Bauhinia variegata</i> L.	Caesalpinaceae	Pipali sag	<i>Piper sarmentosum</i> Roxb.	Piperaceae
Mari patti	<i>Caryota mitis</i> Linn.	Arecaceae	Lettuce tree	<i>Pisonia grandis</i> R.Br.	Nyctaginaceae
Medakbhaji	<i>Centella asiatica</i> (L.) Urban	Amaranthaceae	Nunabhaji	<i>Portulaca oleracea</i> L.	Portulacaceae
Mitha bhaji	<i>Champereia manillana</i> (Blume) merr.	Opiliaceae	Chakur mani	<i>Saurisops androgynus</i> (L.) Merr.	Euphorbiaceae
Kundru	<i>Coccinia grandis</i> (L.) J. Voigt	Cucurbitaceae	Agathi	<i>Sesbania grandifolia</i> Pers.	Fabaceae
Shantibhaji	<i>Alternanthera dentata</i> L.	Amaranthaceae	Wild brinjal	<i>Solanum torvum</i> L.	Solanaceae
Ghuniya	<i>Colocasia esculenta</i> (L.) Schott	Araceae	Imli	<i>Tamarindus indica</i> Linn.	Caesalpiniaceae
Patt/Jute	<i>Corchorus capsularis</i> L.	Tiliaceae	Chichinda	<i>Trichosanthes anguina</i> L.	Cucurbitaceae
Chalta	<i>Dillenia indica</i> L,	Dilleniaceae	Kundru	<i>T. dioica</i> L.	Cucurbitaceae
	<i>D. pentagyna</i> Rox.		Putkal	<i>Ficus virens</i> Ait.	Moraceae

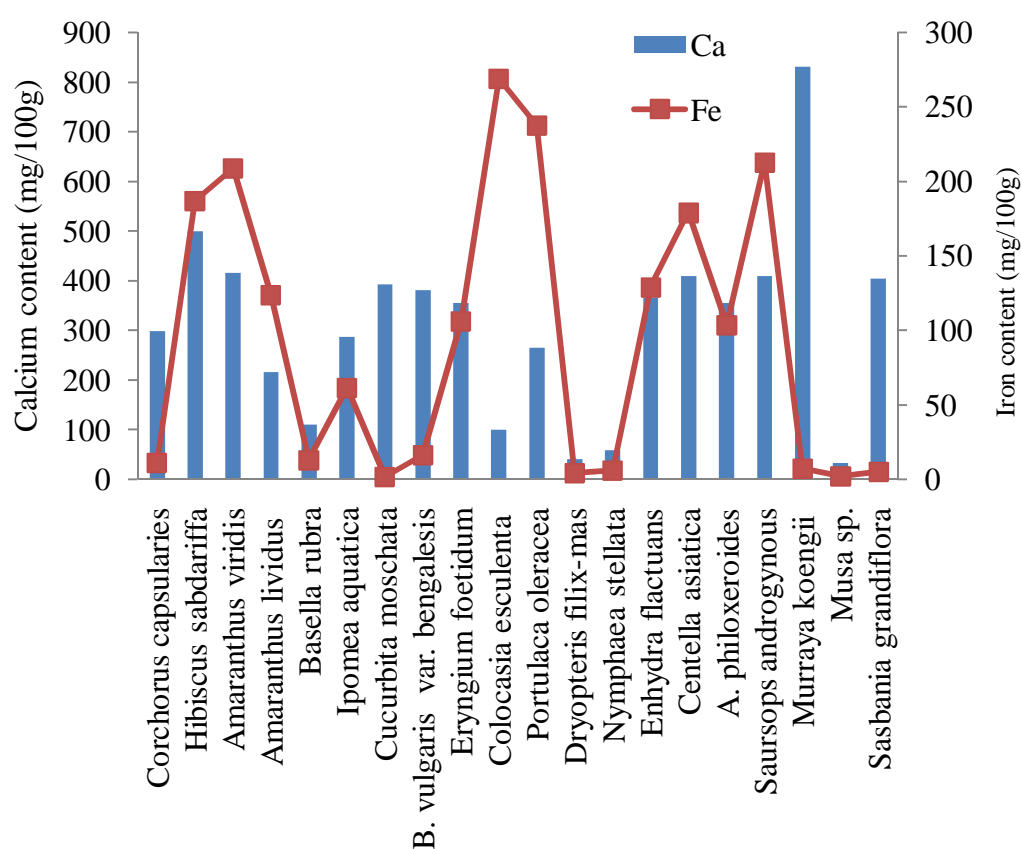
Dekibhaji	Dryopteris filix-mas (L.) Schott	Polypodiaceae	Cowphal	Garcinia cowa Roxb. Ex. DC	Clusiaceae
Helencho	Enhydra fluctuans Lour	Asteraceae	Khatabhaji	Hibiscus sabdariffa	Malvaceae
Broad dhaniya	Eryngium foetidum L.	Apiaceae	Nallibhaji	Ipomea aquatica Forsk	Convolvulaceae
Dumoor	Ficus hispida Linn.f.	Moraceae	Malenc ho	Jussiaea repens L.	Onagraceae

### 3.3 Traditional health perceptions

Though traditional vegetables were predominantly used as food source but some of them also got acclaimed for their medicinal properties. Local people use them for curing the health problems like anemia, vision, skin problems, digestive irregularities, scurvy, wound healing, intestinal worms etc. The indigenous vegetables of islands have manifold traditional health perceptions as shared by the respondents. *Enhydra fluctuans* and *Azadirachta indica* are most popular medicine for clearing intestinal worms while *Centella asiatica* for treating mouth ulcers, *Hibiscus sabdariffa* for dyspepsia and piles, *Nymphaea stellata* as anti-diabetic, *Portulaca oleracea* for snake bite, *Ipomea aquatica* for heat strokes and *Enhydra fluctuans* for small pox. Tribes also use leaf paste on face and hands to prevent from sun burn or UV rays. Similarly, Pieroni and Torry (2007) also reported key role of indigenous vegetables of ethnic Asian communities in Europe. Their health benefits are probably due to richness in crude fibre, micronutrients,  $\beta$ -carotene and phytochemicals (Frison et al., 2006; Singh et al. 2011a).

### 3.4 Nutritive value of indigenous vegetables

Nutritive analysis of indigenous vegetables revealed that these are rich in dietary micronutrients and antioxidants than most of the commercial vegetables. Estimation of Ca and Fe using Atomic absorption spectrophotometer revealed that indigenous vegetables as their rich sources (Fig. 1). Singh et al. (2012) also reported high content of micronutrients particularly in iron, calcium, zinc and copper in ten indigenous vegetables of Andaman and Nicobar Islands. They also highlighted the health benefiting phytochemicals in these vegetables which showed better contents than most of the commercial exotic vegetables. Similarly, the Baruah and Bora (2008) reported the nutritional profiles of indigenous vegetables of North-East India and suggested their use in nutritional schemes. The high acceptance of indigenous vegetables among local women and elderly people in rural and tribal regions can popularize these cost effective and environment friendly high density nutrient sources for their nutritional security (FAO, 1988).



**Fig. 1:** Calcium and iron content in some selected indigenous vegetables of islands.

### 3.4 Stress tolerance of indigenous vegetables

The indigenous vegetables have better tolerance to biotic and abiotic stresses such as diseases and pests which reduce the use of chemical inputs and favour ecosystem concept (Singh et al. 2011). Biotic tolerance could be due to their phytochemical profiles which contribute in insect repellence or inhibit establishment or growth of microbes (Thakur and Sohal, 2013). Abiotic stress tolerance is also inherent in their genetic makeup which established by the natural selection process. These species face two contrast climatic extremities like drought, high incidence of ultra-violet (UV) rays and high canopy temperature during dry months (February-April), and water logging, high humidity (>90%), low sun light, weed competence, poor soil conditions during prolonged rainy season (May- November). These indigenous vegetables might have common or different survival mechanisms in such stress situations which is an investigable issue.

### 3.5 Genetic improvement for nutrients and high yield

The conservation and improvement of germplasm of the selected indigenous vegetables from islands is under way for better quality, yield, uniformity and stress tolerance. The superior genotypes/varieties developed are CARI, Port Blair from local collections of indigenous vegetables (Table 3) can play key role in providing intake of more micronutrients with diet.

**Table 2:** Developed varieties/ genotypes of indigenous vegetables for islands conditions.

A. Crop	B. Variety/genotype	C. Characteristics
D. <i>Eryngium foetidum</i> L.	E. CARI Broad Dhaniya	F. Broad leaves, rich in Fe, Ca and carotenoids and high yield
G. <i>Basella alba</i> L.	H. CARI Poi Selection	I. Large, green leaves, rich in Fe, Ca, carotenoids, high yield
J. <i>Basella rubra</i> L.	K. CARI-Poi Red	L. Medium size leaves, red veins, rich in Fe, Ca and anthocyanin
M. <i>Momordica dioica</i> Roxb	N. CARI Kakrol	O. Attractive green fruits, tolerant to temporary water logged soils
P. <i>Amaranthus viridis</i> L.	Q. CARI-AMA-Green	R. Broad leaves, early, high yield, rich in Ca, Fe and carotenoids
S. <i>Amaranthus tricolour</i> L.	T. CARI AMA-Red	U. Purple leaves, early, high yield, rich in Ca, Fe and anthocyanin
V. <i>Hibiscus sabdariffa</i> L.	W. CARI HS-1	X. Early, high yielding, rich in Fe, Ca, phenolics and carotenoids
a) <i>Centella asiatica</i> (L.) Urban	Y. CARI CA-5	Z. Rich in micronutrients, antioxidants, broad leaves, rapid growing
a) <i>Ipomea aquatica</i> L.	AA. CARI NB-4	BB. Fast growing, high yield, rich in K, Zn, Mg, Fe, Ca, ascorbic acid
a) <i>Portulaca oleracea</i> L.	CC. CARI DB-8	DD. Rich in Fe, Mn, Mg, phenolics and ascorbic acid

### 3.6 Household fortification with indigenous vegetables: a new concept

The indigenous vegetables have less preference among children particularly in rich and educated rural and urban households than exotic vegetables. Thus, high content of

micronutrients in these vegetables can be supplied to children through household fortification of their staple foods or fast food items like biscuits, *idli*, *vada*, *pakora*, sandwich, chutney, *paratha*, *kurkure* etc at household or *aganwadi* or school (mid day meal scheme) levels. This concept will help in increase in intake of essential micronutrients like Ca, Zn, Fe,  $\beta$ -carotene and ascorbic acid by these vegetables. The concept will assist in targeting the micronutrient malnutrition along with food security schemes in marginal communities. Their frequent intake should be prescribed for *aganwadi* and mid day meal schemes. The powder of drumstick, amaranthus and broad dhaniya is used for supplementing the dietary items for pregnant women and children in health conscious households.

#### 4. Utilization Strategies

- Development/identification of island specific high yielding, disease and pest resistant varieties of vegetables.
- Develop a platform to exchange and conserve information and materials, identify key task and relevant lead centres for networking of research and development activities to address key knowledge gaps and resource needs for nutritional security, climate change associated stresses, heat tolerance, flooding and salinity tolerance by participatory approach with indigenous and advance knowledge for promising indigenous vegetables.
- The efforts on collection and conservation of indigenous vegetables germplasm need to be strengthened by developing *ex-situ* conservation block or through participatory approach.
- Experiments for establishing the role of vegetables in improving micronutrient in human.
- Selective habitat enrichment for identified indigenous vegetables and their promotion.

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