



FOODS AND NUTRITION NEWS

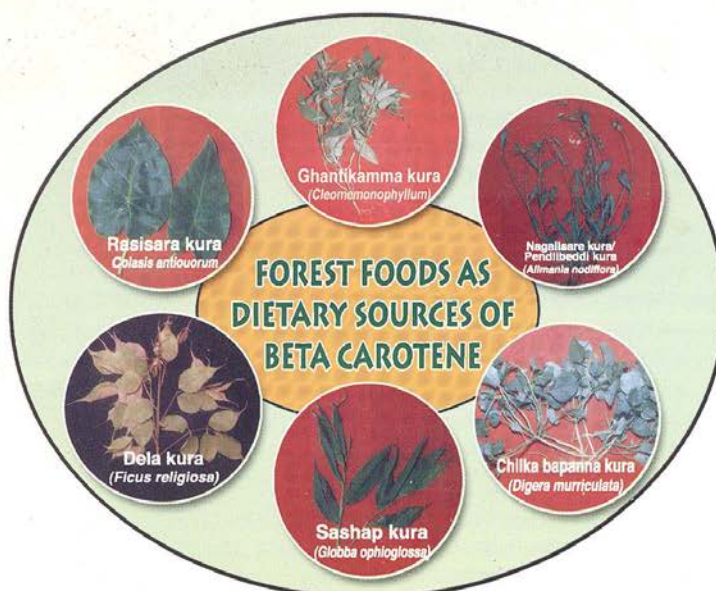
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FOREST FOODS AS DIETARY SOURCES OF BETA CAROTENE



Carotenoids are an array of compounds which currently consume both scientific and popular interest because of their varied health promoting functions/actions. Carotenoids derived from plant foods are the chief sources of vitamin A in the diets of many population groups in developing countries. Among various carotenoids, beta carotene is the most abundant in plant foods, and has maximum relative activity as compared to other carotenoids (Table 1).

For dietary carotenoids, it is generally acknowledged that in terms of vitamin A activity, 6 ug of beta carotene or 12 ug of mixed dietary carotenoids are converted to 1 ug of retinal (WHO, 1982). Among various carotenoids, beta carotene is the most abundant in plant foods, and has maximum vitamin A activity as compared to other carotenoids. The net retinol equivalents of 1 ug

Table 1 : Relative activity of carotenoids

| Carotenoids | Colour | Relative activity percent |
|----------------|--------------|---------------------------|
| Beta carotene | orange | 100 |
| Alpha carotene | light yellow | 50-54 |
| Gamma carotene | red-orange | 42-50 |
| Lycopene | red | inactive |
| Cryptoxanthin | orange | 50-60 |

of dietary beta carotene is 0.25 ug.

The pro vitamin A activity of carotene containing plant foods will depend upon the proportion of these carotenes present in the carotenoid pigments of these foods. Carotenoids are said to have various health promoting functions or actions (fig. 1).

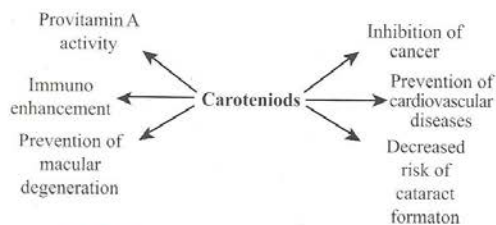


Fig.1: Health promoting functions or actions attributed to carotenoids

The World Health Organization (WHO) micronutrient deficiency information system (MDIS) indicates that over 90 countries have a public health problem with regard to clinical and or sub clinical vitamin A deficiency (VAD). It is reported that 25 per cent of the 15 million blind in the world are from India; about a fifth can trace the origin to VAD. It is well known that VAD is primarily due to dietary inadequacy. Plant foods form the major source of pro vitamin A carotenoids in Indian diets. Poor people obtain most of their nutrients from plant foods, which are cheaper than animal foods. Because of the increase in world population and the demands for beta-carotene food sources and the insufficiency of traditional foods rich in beta carotene, recognizing and promotion of wild edible plant resources in a developing country like India is of paramount importance.

Forests are the repository of various nutritious foods that grow wild and are neither cultivated nor marketed. The forest clad mountains and hills are the original habitats of hundreds of tribal groups in India and they have traditional knowledge of identifying and processing the foods available in nature to which they are habituated for generations. However, there is no documentation related to vitamin A activity of these foods.

Indian Council of Agricultural Research (ICAR), New Delhi, came forward to fully finance an adhoc research project entitled "Screening of forest foods consumed by tribals for beta carotene content" which was carried out during 1997-2001 at Post Graduate and Research Centre, Department of Foods and Nutrition, ANGRAU, Rajendranagar. The study was conducted in Andhra Pradesh, the traditional home of nearly 33 tribal groups and most of them are found in the borderlines of North and North East region. For the purpose of the study the Integrated Tribal Development Agency (ITDA) areas in the five districts Visakhapatnam, Vizianagaram, East Godavari, Kurnool and Prakasam, where tribal population is concentrated were explored.

Beta carotene content in forest foods

One hundred and seven edible forest foods consisting of 70 green leafy vegetables, 8 vegetables, 22 fruits and 7 stored products prepared by the tribals were screened for beta carotene content and vitamin A activity is expressed as retinal equivalents (RE)

Vitamin A activity of edible forest green leafy vegetables

Among the 70 green leafy vegetables, 36 green leafy vegetables had high vitamin A activity (0.87 to 2.34 RE) with Total Carotenoids and Beta carotene content ranged from 12.22 to 36.13 and 5.21 to 14.05 mg % respectively. Thirty green leafy vegetables had moderate vitamin A activity (0.36 to 0.8 RE) with Total Carotenoids and Beta carotene contents ranged from 10.60 to 31.33 and 2.19 to 4.78 mg %. Four green leafy vegetables contained low vitamin A activity (0.07 to 0.32 RE). Table 2.

Table 2: Edible forest Green leafy vegetables with high and moderate vitamin A activity

| High vitamin A activity | Moderate vitamin A activity |
|---|--|
| Acacia concinna (<i>Sikkaya chiguru</i>) | Aerva sanguinolenta (<i>pedda pindikura</i>) |
| Achyranthes aspera (<i>Dukkina kura</i>) | Amorphophallus campanulatus (<i>vurikanda aku</i>) |
| Adintum lunatua (<i>amusiukura</i>) | Antidesma acidus (<i>puleru kura</i>) |
| Aerva lanta (<i>Pindi kura</i>) | Basella rubra (<i>yerra bacchali</i>) |
| Allamania nodiflora (<i>Nagali sarekura / Pendilibeddi kura</i>) | Boerhavia diffusa (<i>teddukamma kura</i>) |
| Alternanthera sessilis (<i>ponnaganti kura / simhadri kura</i>) | Canthium parviflorum (<i>balusu kura</i>) |
| Amaranthus Gangeticus (<i>perugu thota kura</i>) | Capsicum frutesans (<i>chirumirapakaya kura</i>) |
| Amaranthus lividis (<i>tella thota kura</i>) | Commelina benghalensis (<i>venneduru/doraga kura</i>) |
| Amaranthus polygamus (<i>daggulakura</i>) | Cucurbita maxima (<i>gummadiaku/ gummadi chiguru</i>) |
| Amaranthus spinosus (<i>mullukura</i>) | Dryopteris cochleata (<i>garisa kura</i>) |
| Amaranthus viridis (<i>puvvu thotakura</i>) | Ficus cunia (<i>chittikura</i>) |
| Amorphophallus sylvaticus (<i>adavikanda</i>) | Gisekia pharmaceoides (<i>Isukarasikura</i>) |

Maintain ideal body weight

| | |
|--|---|
| <i>Bauhinia purpurea</i> (peddamakula/bodantam/ goddu/dodrungkura) | <i>Gmelina arborea</i> (adavigummadikura) |
| <i>Cassia occidentalis</i> (peddatantemkura) | <i>Hevea brasiliensis</i> (chikka kura) |
| <i>Cassia tora</i> (chinnatantem/ tantebbukura) | <i>Ipomea sepiaria</i> (korla kura) |
| <i>Celosia argentea</i> (gurumkura) | <i>Leucas aspera</i> (china tummi kura) |
| <i>Cocculus hirsutus</i> (cheepurukura) | <i>Leucas cephalotes</i> (peddatdummi kura) |
| <i>Cleome monophyllum</i> (gantikkammakura) | <i>Lygodium microphyllum</i> (kolemkura) |
| <i>Figera arvensis</i> (chenchalkura) | <i>Meremia emarginata</i> (elakachevula ira) |
| <i>Digeria murriculata</i> (chilka bappanakura) | <i>Murraya ko-eingil</i> (konda karivepaku) |
| <i>Erythroxylum mongynum</i> (devadarikura) | <i>Phyllanthus maderaspatensis</i> (chintala kura) |
| <i>Ficus religiosa</i> (delakura) | <i>Pteridium aquilinum</i> (konkadikura) |
| <i>Globa bulbifera</i> (sashepkura) | <i>Pygmaeopremna herbacea</i> (ghanta bharanikura) |
| <i>Gynandropsis pentaphylla</i> (whitekura) | <i>PyTalinum erneiformis</i> (tellabacchali kura) |
| <i>Hibiscus abelmoschus</i> (nelabenda) | Desarikura (unidentified) |
| <i>Hibiscus cannabinus</i> (janapakura) | Mandikura (unidentified) |
| <i>Jasmine augustifolium</i> (mellikura) | |
| <i>Lepidium sativum</i> (podikura) | <i>Pedicularis flortantam</i> (goddu/godruny kura) |
| <i>Moringa oleifera</i> (munaagakura) | <i>Bauhinia purpurea</i> |
| <i>Oxalis corniculata</i> (pilliadugua kura) | |
| <i>Physalis minima</i> (silleru kura) | |
| <i>Premna latifolia</i> (doddanellikura/nellikura) | |
| <i>Rivea hypocrateriformis</i> (beddikura) | |
| <i>Solanum nigrum</i> (gajukura) | |
| <i>Trianthema portulacastrum</i> (ambalimadukura) | |

Local names are given in italics

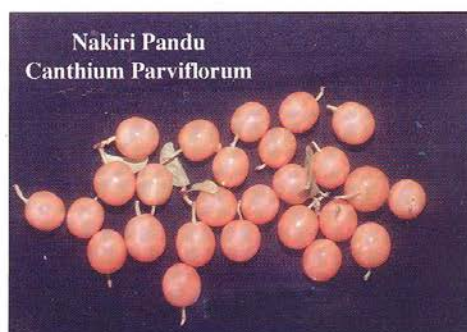


Fig. 2 Forest fruit rich in beta carotene

Other vegetables, roots and tubers showed negligible vitamin A activity with Total carotenoids and beta carotene content ranging from 0.01 to 0.61 and 0.14 to 0.23 mg % respectively.

Among the 22 fruits, *Canthium parviflorum* (Fig. 2) contained very high Total carotenoids (9.51 mg %) and Beta carotene (6.10 mg %) contents, where as other fruits contained negligible content of Total Carotenoids (0.0015 to 1.32 mg %) and Beta carotene (0.004 to 0.49 mg %). Another fruit *Diosphros melanoxylon*, contained no beta carotene in the pulp portion but the rind portion both fresh and dried contained 0.79 and 2.17 mg % respectively.

Effect of processing on Beta carotene content in forest Green Leafy Vegetables

Beta carotene is known to be heat labile. Certain processing methods followed prior to preparation of foods affect vitamin A activity of carotenoids. Boiling Green Leafy Vegetables in large amount of water (1:2) with or without draining is the common cooking practice adopted by tribals. Boiling of the Green Leafy Vegetables by tribal methods showed wide variation in the retention of beta carotene. The per cent losses of Total Carotenoids and Beta carotene contents due to boiling ranged from 5.67 to 84.14 and 2.66 to 92.34 mg % respectively which were not proportional to cooking time. Some of the forest Green Leafy Vegetables found to be more stable to heat in that they retained higher per cent of beta carotene even after heat processing as compared to others. Among them *Pedatantem kura* (*Cassia occidentalis*), *Chinatantem kura* (*Cassia tora*), *Puvvu thotakura* (*Amaranthus viridis*), *Ghantikamma kura* (*Cleome monophyllum*), *Chilka bappena kura*, (*Digeria murriculata*), and *Beddikura* (*Rivea hypocrateriformis*) needs special mention having both high vitamin A activity and also maximum (75 to 98 %) retention of beta carotene on heat processing.

Beta carotene content in traditional products of tribals

Generally, green leafy vegetables are boiled and to which a ground paste of chillies and salt are added and seasoned (optional) with red chillies and mustard seeds. Green leafy vegetables with combination of dhal or broken rice or addition of tamarind extract are commonly practiced by tribal communities.

Among the traditional products of the tribals with green leafy vegetables, curry prepared with cooking water retained had a maximum retention of Beta carotene followed by shallow fried and ground to make chutney. Green leafy vegetables cooked with tamarind extract showed the least retention (0.42 to 3.52%) of Beta carotene.

Tribals generally do not store perishables for long or even for short duration. However, mangoes when available in plenty, the juice is extracted and spread in several layers one on top of the other on bamboo mat to required thickness and sun dried. The product locally known as *mamidi thandra*, is stored by tribals for an year and the product contained 1.09 mg % beta carotene.

Tribals inhabiting the forests have exploited nature for their living and have a wealth of knowledge about the

foods that are edible. Identification, production and popularization of unfamiliar and underutilized carotene rich forest foods would enable both dietary diversity and improvement in vitamin A nutritional status of the population at large.

Points of concern and importance

- The vast potential of forests as a repository of variety of vitamin A rich foods is not yet fully realized
- The hill tribes possess abundant traditional knowledge about various forest species and techniques of utilisation of some of the species which ensures their regeneration
- Feasibility of propagation of these foods in non tribal areas require attention. Finding diverse recipes and value added products and the bio availability of carotene from vitamin A rich forest foods need to be undertaken.
- The tribals follow certain native treatment for eye related diseases which need to be further explored.
- Some of the vitamin A rich dietary sources may be used for genetic manipulation for the benefit of mankind.

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