

RESEARCH ARTICLE

## Diversity of Vegetables from the Markets of Chennai, Tamil Nadu, India

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### Abstract

Consumption of vegetables and traditional greens are a major source of vitamins and micronutrients. They are reported to be rich in protein, essential minerals and vitamins. The present study provides an overview of the use and status of 86 vegetables in the markets of Chennai, Tamil Nadu, India. Field visits were made to the local markets in and around Chennai covering nearly 30 km<sup>2</sup> and major survey were done from Koyambedu Wholesale Market Complex (KWMC), Chennai and its environs. Data were collected using semi-structures interviews mediated by questionnaires with the vegetable vendors. Data collection was complemented by asking for information concerning each of the products encountered. Assessment of the diversity of vegetables available in the markets could be used as a benchmark for their production.

**Keywords:** Vegetables, vitamins, micronutrients, diversity, consumption, Chennai.

### Introduction

Markets are public places where many varieties of systems, institutions, procedures, social relations and infrastructures whereby parties engage in exchange. These spaces are unique and distinctive for a given culture or society because they represent small-scale reproductions of that region's cultural and biological diversity. It is observed that different space is provided for different goods and these spaces unite, maintain and disseminate different knowledge from different people and of different regions as well as origins (Albuquerque *et al.*, 2007). India is one among the 17 megadiverse countries (Mittermeier *et al.*, 1997) with rich biodiversity in three biodiversity hotspots (Mittermeier *et al.*, 2004; Conservation International, 2007). This biodiversity is eroding in a fastest rate by various reasons. Especially agricultural biodiversity is facing enormous threat by various factors and one among is that genetically manipulated crops. In the course of time, Farmers/local/indigenous people have cultivated, managed, developed and conserved diversity, for e.g. through landraces. About 30,000 edible plants are found throughout the world, of which 7,000 are grown or collected as food (Natarajan, 2002). But the whole world is presently dependent on a few plant species. Only 30 plant species provide 95% of the world's food (FAO, 1996) but in many parts of the world, the use of wild plants is very common (Bussmann and Sharon, 2006; Kunwar *et al.*, 2006; Cavender 2006; Pieroni *et al.*, 2007; Singh *et al.*, 2012). However, increasing human population demands hybridized crops with surplus production. Technically all plants are vegetables, however, this term may be defined as edible seeds or roots or stems or leaves or bulbs or tubers or non-sweet fruits of plant that are usually eaten cooked or raw as

salad (Hill, 1972; Yamaguchi, 1983; Vainio, and Bianchini, 2003; Collin, 2004). They make up a major portion of the diet of humans and are critical for good health. With the onset of market economy and modernization of agriculture, conservation of traditional or indigenous vegetables left out over exotic vegetables (Keding *et al.*, 2007). These exotic vegetables may provide new revenue opportunities and high returns per acre to local market growers. A recent National Geographic article, "Our Dwindling Food Variety," highlights an important issue that the rapid rate at which heirloom vegetable varieties are disappearing and the overall reduction in commercially available variety diversity. The article cites a 1983 study by the Rural Advancement Foundation International, which "compared USDA listings of seed varieties sold by commercial U.S. seed houses in 1903 with those in the U.S. National Seed Storage Laboratory in 1983." The study had striking results: 93% of the varieties had gone extinct. The National Geographic article concludes, "More up-to-date studies are needed," (Anonymous, 2014) and the present study is to understand the diversity of vegetables sold in the markets of Chennai and its environs and assessed the nature of diversity exist among the availability of vegetables. This focuses on the following question:

What different types of vegetables are present in the study area and what are their characteristics?

### Materials and methods

Field visits were made to the local markets in and around Chennai covering nearly 30 km<sup>2</sup>. Major survey was done from Koyambedu Wholesale Market Complex (KWMC), Chennai and its environs.

KWMC is the major market place in Chennai for vegetables, fruits and flowers. One of the Asia's largest market place fulfils the demand of the fast growing metropolitan city, Chennai. There are two divisions in the vegetable market phase in KWMC. Wholesale and retail selling are the two important divisions in KWMC. Wholesale sellers finish their business before 9 a.m. whereas retail sale goes on till 9 p.m. Vegetables were collected and brought to the laboratory and identified the same using floras and manuals. The following books served as an important asset to identify: Singh *et al.* (1983); Simpson and Ogorzaly (2001) and Wyk (2005). Data were collected using semi-structured interviews mediated by questionnaires with the vegetable vendors. The free-listing technique was most useful tool when associated with direct observation of the products being sold. Data collection was complemented by asking for information concerning each of the products encountered.

### Results and discussion

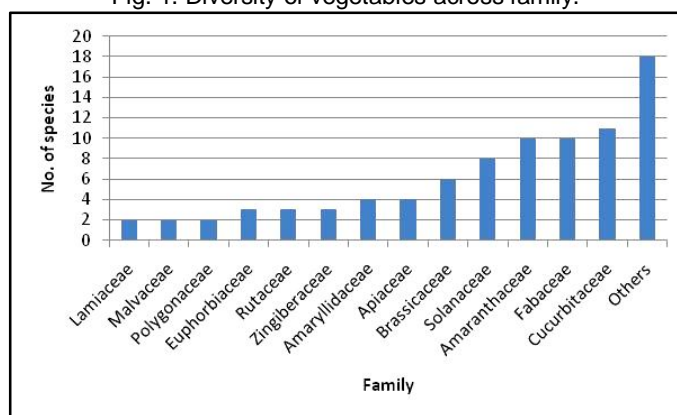
KWMC is a market solely dependent on truck growing. Truck growing is nothing but the production of crops in large quantities for distant markets (Thompson and Kelly, 1957). Vegetables are classified according to different criteria: 1. Botanical classification, 2. Classification based on hardness, 3. Classification based on the parts of the plant consumed (Table 1) or colour of the vegetable or according to the nutrition values and 4. Classification based on essential methods of culture (Thompson and Kelly, 1957; Katyal, 1977; Gopalakrishnan, 2007). A total of 86 species belonging to 61 genera and 31 families were identified in the study. Out of 86 species, 84 belong to angiosperms and one each from pteridophytes and fungi (Table 2). It provides a database regarding the vegetables available in the markets of Chennai. Chennai (formerly Madras) is an urban town located in the southern state of India and capital of Tamil Nadu. It is a fast growing metropolitan city in a developing country and it confronts various problems and changes. Once self sustainable city, now it is depends on transport market economy for its sustenance. Almost all vegetables are coming from faraway places except some leafy vegetables. One of Asia's largest perishable goods market complex, KWMC located at Koyambedu, Chennai was surveyed for this present study, apart from various markets of Chennai and its environs. We have used APG III (2009) classification for enumeration of families.

In the present study, most species belong to genera *Solanum* (7) and *Allium*, *Alternanthera*, *Amaranthus*, *Brassica* shares each 4 species whereas *Citrus*, *Cucumis*, *Curcuma*, *Phaseolus*, *Raphanus*, *Rumex* and *Trichosanthes* with each 2 species. Remaining genera are represented by one species each. Cucurbitaceae vegetables are dominating with 11 species in the markets of Chennai and it is followed by Fabaceae and Amaranthaceae with 10 species each. About 18 families are represented by each one species (Fig. 1).

Table 1. Classification of vegetables based on parts used for consumption (Gopalakrishnan, 2007).

Group	Examples
Roots	Carrot, Beet root, Radish
Tubers	Potato, Sweet potato, Tapioca
Bulb	Onion, Garlic
Stems	Ginger, Amaranth stem
Leaves	Cabbage, Amaranth
Flowers	Cauliflower, Plantain flower
Fruits	Tomato, Pumpkin, Drumstick
Legumes	Peas, Beans
Seed sprouts	Green gram, Bengal gram
Fungi	Mushrooms

Fig. 1. Diversity of vegetables across family.



Fruit vegetables are dominating followed by leafy vegetables in the present study. Some species are having more than one useful part. Some of the vegetables surveyed having more number of varieties or cultivars. For e.g. brinjal is having more than 6 different varieties. Tomato is basically having 2 different varieties. Fruit with thick outer coat is known as 'Bangalore tomato', whereas the other one with thin fruit coat is known as 'country tomato'. Likewise several varieties of onion and chilly is available in the market. Most of the vegetables come from faraway places whereas some of the vegetables come from neighbourhood districts. Some of the seasonal leafy vegetables like *Alternanthera* spp. and *Sphagneticola calendulacea* come from nearby places and they are not always available at the KWMC. Herbs like *Cardiospermum halicacabum*, *Solanum trilobatum* and *Aerva lanata* are considered as medicinal and not available regularly in KWMC whereas they are available at other markets of Chennai. The present survey showed that the exotic vegetables were replacing the traditional ones in the diet. Only 12 species are strict Indian origin whereas many species are multiple origin and exotic (Table 2). There were many traditional wild and semi-wild species that have potential economic value as fruits, vegetables or medicinal plants. But these species are not available in the KWMC. There is a trend of looking exotic vegetables instead of indigenous vegetables which are not available at local markets. Growing and selling of these indigenous vegetables should be encouraged as a way of conserving agro-biodiversity.

Table 2. Diversity of vegetables listed from markets of Chennai and its environs.

S.No.	Name	Family	Common Name	Tamil Name	Nativity	Useful parts
1	<i>Abelmoschus esculentus</i> (L.) Moench	Malvaceae	Lady's finger	Vendaikkai	Old world tropic	Fruit
2	<i>Acalypha indica</i> L.	Euphorbiaceae	Indian acalypha	Kuppaimeni keerai	South Asia	Whole plant
3	<i>Aerva lanata</i> (L.) Juss. ex Schult.	Amaranthaceae		Sirukan peelai keerai	Tropical Asia	Whole plant
4	<i>Agaricus bisporus</i> (J.E.Lange) Emil J. Imbach	Agaricaceae	Button mushroom	Kaalaan	Europe and North America	Whole
5	<i>Allium ampeloprasum</i> L.	Amaryllidaceae	Leeks	Vengayatthal	Mediterranean region	Leaves
6	<i>Allium cepa</i> L.	Amaryllidaceae	Onion	Vengayam	Mediterranean region	Fleshy scale leaves
7	<i>Allium cepa</i> L. var. <i>aggregatum</i> G. Don.	Amaryllidaceae	Shallot onion	Sambar/Chinna vengayam	Mediterranean region	Fleshy scale leaves
8	<i>Allium sativum</i> L.	Amaryllidaceae	Garlic	Vellai/Ullee Poondu	Central Asia	Bulbs
9	<i>Alternanthera bettzickiana</i> (Regel) G.Nicholson	Amaranthaceae	Jacob's coat	Seemai Ponnangannee	Tropical America	Leaves
10	<i>Alternanthera paronychioides</i> A. St.-Hil. var. <i>paronychioides</i>	Amaranthaceae	Smooth Joyweed	Seemai Ponnangannee	Tropical America	Leaves
11	<i>Alternanthera philoxeroides</i> Griseb.	Amaranthaceae	Alligator weed	Seemai Ponnangannee	Tropical America	Leaves
12	<i>Alternanthera sessilis</i> (L.) R.Br. ex DC.	Amaranthaceae	sessile joyweed	Ponnangannee	India	Leaves
13	<i>Amaranthus blitum</i> L.	Amaranthaceae		Siru keerai	Mediterranean region	Leaves
14	<i>Amaranthus dubius</i> Mart. ex Thell.	Amaranthaceae	Red spinach	Arakkeerai	South America	Leaves
15	<i>Amaranthus retroflexus</i> L.	Amaranthaceae	Red-root amaranth	Siru keerai	Tropical America	Leaves
16	<i>Amaranthus tricolor</i> L.	Amaranthaceae	Joseph's Coat	Thandu/Arai keerai	South America	Leaves
17	<i>Amorphophallus paeoniifolius</i> (Dennst.) Nicolson	Araceae	Elephant yam	Karunai/Senai Kizhangu	Indonesia	Tuber
18	<i>Arachis hypogaea</i> L.	Fabaceae	Ground nut	Vear/Nila Kadalai	Brazil	Pulses
19	<i>Basella alba</i> L.	Basellaceae	Vein spinach	Palak keerai	Southeast Asia	Leaves
20	<i>Benincasa hispida</i> (Thunb.) Cogn.	Cucurbitaceae	Ash gourd	Suraikai	Southeast Asia	Fruit
21	<i>Beta vulgaris</i> L.	Amaranthaceae	Beet root	Beet root	South Europe	Underground fleshy taproot
22	<i>Brassica oleracea</i> Gongylodes group	Brassicaceae	Khol-khol	Nukkal	Europe	Underground stem
23	<i>Brassica oleracea</i> L. var. <i>botrytis</i> L.	Brassicaceae	Cauli flower	Kovippu/Kaali flower	Central Europe	Inflorescence
24	<i>Brassica oleracea</i> L. var. <i>capitata</i> L. f. <i>alba</i> DC.	Brassicaceae	Cabbage	Muttai Kose	Europe	Leaves
25	<i>Brassica rapa</i> var. <i>rapa</i> L.	Brassicaceae	Turnip	Turnip	Europe	Roots
26	<i>Capsicum annuum</i> L.	Solanaceae	Chillies	Pachai milagai	Tropical America	Immature fruit
27	<i>Cardiospermum halicacabum</i> L.	Sapindaceae	Balloon Vine	Moodakkatthaan Keerai	South Asia	Leaves
28	<i>Carica papaya</i> L.	Caricaceae	Papaya	Pappaalee	Tropical America	Whole fruit
29	<i>Centella asiatica</i> (L.) Urb.	Apiaceae	Asiatic Pennywort	Vallarai Keerai	Old world tropics	Leaves and stem
30	<i>Cissus quadrangularis</i> L.	Vitaceae		Kodi Perandai/Vajra Valli	Old world tropics, South Africa	Stem
31	<i>Citrus limon</i> (L.) Burm.f.	Rutaceae	Lemon	Elumichai		Fruit
32	<i>Citrus medica</i> L.	Rutaceae	Citron	Narhangai	Southeast Asia	Fruit
33	<i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceae	Ivy Gourd	Kovakkai	Old world	Immature fruit
34	<i>Cocos nucifera</i> L.	Arecaceae	Coconut	Thengai	Samar, Philippines	Solid endosperm
35	<i>Commelina benghalensis</i> L.	Commelinaceae		Kanaang kozhai	India	Young shoots
36	<i>Coriandrum sativum</i> L.	Apiaceae	Coriander	Kotthamalli	South West Asia	Young shoots

37	<i>Cucumis melo</i> L.	Cucurbitaceae	Ogen Melons	Mulaam Pazham	West Africa	Immature fruit
38	<i>Cucumis sativus</i> L.	Cucurbitaceae	Cucumber	Vellarikkai	India	Fruit
39	<i>Cucurbita maxima</i> Duchesne	Cucurbitaceae	Pumpkin	Poosanikkai/ Parangeekkai	Tropical America	Fruit
40	<i>Curcuma amada</i> Roxb.	Zingiberaceae	Mango ginger	Maa Inchi	India	Underground stem-Rhizome
41	<i>Curcuma longa</i> L.	Zingiberaceae	Turmeric	Manja kizhangu	Southeast India	Underground stem-Rhizome
42	<i>Cyamopsis tetragonoloba</i> (L.) Taub.	Fabaceae	Cluster beans	Kothavarai		Immature fruit
43	<i>Daucus carota</i> L.	Apiaceae	Carrot	Carrot	Western Asia	Roots and Leaves
44	<i>Decalepis hamiltonii</i> Wight & Arn.	Apocynaceae	Swallow root	Magalikkizhangu	Peninsular India	Roots
45	<i>Euphorbia hirta</i> L.	Euphorbiaceae		Amman Pacharisi Keerai	India	Whole plant
46	<i>Foeniculum vulgare</i> Mill.	Apiaceae	Fennel	Sombu keerai	Mediterranean region	Leaves
47	<i>Glycine max</i> (L.) Merr.	Fabaceae	Soya bean	Soya avarai	East Asia	Pods, Seeds
48	<i>Hibiscus cannabinus</i> L.	Malvaceae	Deccan Hemp	Pulicha keerai	Southern Asia	Leaves
49	<i>Ipomoea batatas</i> (L.) Lam.	Convolvulaceae	Sweet potato	Sarkarai Valli Kizhangu	Mexico	Starchy Tuber
50	<i>Lablab purpureus</i> (L.) Sweet	Fabaceae	Country/Garden beans	Avaraikai	Tropical Asia	Unripe pods
51	<i>Lagenaria siceraria</i> (Molina) Standl.	Cucurbitaceae	Bottle Gourd	Suraikai	India	Fruit
52	<i>Luffa acutangula</i> (L.) Roxb.	Cucurbitaceae	Ribbed/Ridged Gourd	Peerkkangkai	Tropical Asia	Tender fruit
53	<i>Mangifera indica</i> L.	Anacardiaceae	Mango	Maangai	North India, Burma	Fleshy mesocarp
54	<i>Manihot esculenta</i> Crantz.	Euphorbiaceae	Tapioca	Maravalli Kizhangu	South America	Tuber
55	<i>Marsilea quadrifolia</i> L.	Marsileaceae	Four Leaf Clover	Aaraakkeerai	Central and southern Europe	Leaves
56	<i>Mentha arvensis</i> L.	Lamiaceae	Mentha	Pudhina keerai	Europe, Asia	Leaves
57	<i>Momordica charantia</i> L.	Cucurbitaceae	Bitter Gourd	Pagal/Pagarkai	India	Immature fruit
58	<i>Moringa oleifera</i> Lam.	Moringaceae	Drumstick	Moorungai keerai, Moorungai poo, Moorungai kai	North West india	Leaves, Flower, Pods
59	<i>Murraya koenigii</i> (L.) Sprengel	Rutaceae	Curry leaves	Kari vaepilai	India, Srilanka	Leaves
60	<i>Musa paradisiaca</i> L.	Musaceae	Plantain	Vazhai Thandu, Vazhai poo, Vazhai kai	South East Asia	Pseudostem-Inflorescence axis, flower, fruit
61	<i>Phaseolus lunatus</i> L.	Fabaceae	Butter bean		Mesoamerica	Seeds
62	<i>Phaseolus vulgaris</i> L.	Fabaceae	Common Beans	Beans	Tropical America	Immature fruit, Pod, Seed
63	<i>Phyllanthus emblica</i> L.	Phyllanthaceae	Indian gooseberry	Nellikai	Tropical Asia	Fruit
64	<i>Pisonia grandis</i> R.Br.	Nyctaginaceae		Nachukkottai keerai	Andaman and Pacific islands	Leaves
65	<i>Pisum sativum</i> L.	Fabaceae	Peas	Pattanee	Southern Europe	Seeds
66	<i>Plectranthus rotundifolius</i> (Poir.) Spreng.	Lamiaceae	Hausa potato	Siru/Kutti Kizhangu	Tropical Africa	Tuberous underground stem
67	<i>Psophocarpus tetragonolobus</i> (L.) D.C.	Fabaceae	Winged bean	Thengai thuruvi avaraikai	Tropical Asia	Immature pods
68	<i>Raphanus caudatus</i> L.	Brassicaceae	Rat-tail radish	Mougri	Mediterranean region	Immature fruit
69	<i>Raphanus sativus</i> L.	Brassicaceae	Radish	Mullangi	Southeast Asia	Underground fleshy taproot
70	<i>Rumex acetosa</i> L.	Polygonaceae	Common Sorrel	Sakkaravarthi keerai	Europe	Leaves
71	<i>Rumex vesicarius</i> L.	Polygonaceae	Bladder-Dock	Sukkaang Keerai	South West Asia and North Africa	Leaves
72	<i>Sechium edule</i> (Jacq.) Sw.	Cucurbitaceae	Cho-Cho	Bengalore/Seemai kathirikkai	Southern Mexico and Central America	Fruit

73	<i>Sesbania grandiflora</i> (L.) Poiret	Fabaceae	Hummingbird tree	Agatthi keerai	Tropical Asia	Leaves
74	<i>Solanum americanum</i> Mill.	Solanaceae	American nightshade	Manathakkali	Tropical America	Leaves and fruits
75	<i>Solanum lycopersicum</i> L.	Solanaceae	Tomato	Thakkalee	Mexico	Fruit
76	<i>Solanum melongena</i> L.	Solanaceae	Brinjal	Kathirikkai	India	Fruit
77	<i>Solanum nigrum</i> L.	Solanaceae	European black nightshade	Manathakkali	Eurasia	Leaves and fruits
78	<i>Solanum torvum</i> Sw.	Solanaceae	Turkey berry	Sundaikai	Tropical America	Immature fruit
79	<i>Solanum trilobatum</i> L.	Solanaceae		Thuthuvalai keerai	India	Leaves
80	<i>Solanum tuberosum</i> L.	Solanaceae	Potato	Urulai Kizhangu	South America	Starchy Tuber
81	<i>Sphagneticola calendulacea</i> (L.) Pruski	Asteraceae		Manjal karisalai		Leaves
82	<i>Tamarindus indica</i> L.	Caesalpiniaceae	Tamarind	Puliya Maram	Tropical Africa	Leaves and fruits
83	<i>Trichosanthes cucumerina</i> L.	Cucurbitaceae	Snake Gourd	Pudalangkai	India	Fruit
84	<i>Trichosanthes dioica</i> Roxb.	Cucurbitaceae	Pointed Gourd		India	Immature fruit
85	<i>Vigna unguiculata</i> ssp. <i>cylindrica</i> (L.) Verdc.	Fabaceae	Cow pea	Kaaramani	Central Africa	Pods, Seeds
86	<i>Zingiber officinale</i> Rosc.	Zingiberaceae	Ginger	Inchi	South eastern Asia	Underground stem-Rhizome

## Conclusion

The present study reveals that there are around 86 species of vegetables are encountered in the markets of Chennai and its environs. Their characteristic features, common, vernacular names and their place of origin are also highlighted in this study. The study is also emphasize that the lack of nutritional knowledge both among vendors as well as consumers. It is also concluded that the usage of non-indigenous vegetables dominate in the markets of Chennai. However, the present study deciphered that there is a growing interest in the consumption of indigenous medicinally important vegetables. The present study reveals that there are around 86 species of vegetables are encountered in the markets of Chennai and its environs. Their characteristic features, common, vernacular names and their place of origin are also highlighted in this study. The study also emphasize that the lack of nutritional knowledge both among

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