

A review of edible selected green leaves which use in Sri Lankan culinary

Abstract

Green leafy vegetables are providing a better support to human health being. Green leafy vegetables are ionic spring of nutrients, high dietary fibers and rich in vitamins and minerals and with bioactive like phenolic compounds too. The daily eating of green leafy vegetables helps to prevent major diseases like diabetes, cancer, hepato-toxicity etc. due to its medicinal properties like anti-inflammatory, antioxidant and antimicrobial. In Sri Lanka, there are lots of eatable green leafy vegetable grown and these green leafy vegetables are contributing primary role in Sri Lanka cuisine. The main persistence of this article is to discuss about some selected green leafy vegetables and its medicinal properties and its indications in diseases which are used in Sri Lanka cuisine.

Keywords: green leafy vegetables, consumption, anti-inflammatory, antioxidant, antimicrobial

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Introduction

Green leafy vegetables (GLVs) play a dynamic part in food and nutritional security. GLVs are ionic source of many nutrients and form as a key group of vegetables group which has designed as “nature’s anti-aging of wonders”. Numerous vegetables have been exploited as cause of antioxidants. GLVs are the cheapest and being richest nutritional worth. The absence of acquaintance especially on the nutritive value of these GLVs among the community in general is the main disadvantage in their lesser consumption.¹

GLVs contain antioxidants and phenolic compounds which are health-promoting plant secondary metabolites. The WHO recommended that daily allowance of nutrition requirement is at least 400g of fruit and non-starchy vegetables. The American dietary guidelines for Americans recommended five serving of vegetables per day should be green leafy vegetables.²

Further, GLVs are identical significant protecting foods and useful for the conservation of health and for prevention of various diseases. Not only are those GLVs recommended for weight management due to its low energy densities.³

Most developing countries depend on starch-based food. But most Asian countries consumes GLVs and GLVs products like mint leaves. Sri Lanka being consecrated with a variety of natural surrounding and variable growing an array of green leafy vegetables. Sri Lankan food culture is rich with nutrition and taste. And also, Sri Lankan food culture bind with a lot of spices. Green Leaves vegetables have high consumption value and food market in Sri Lanka. That’s why Sri Lankans consumes GLVs in many ways like salad, porridge or flavor enhancement. Dark GLVs are rich sources of minerals like potassium, iron, magnesium and vitamins. But it provides β-carotene, lutein, zeaxanthin and omega m-3 fatty acid prevent cell damage and age related problems by its which protect cells. According to FAO nutrition standards, spinach like GLVs provides all the essential amino acids.² Spinach and fenugreek contain rich source of fiber and which diminish the risk of cardiovascular diseases and colon cancer.

Commercially and commonly available used Sri Lankan culinary green leafy vegetables

Sri Lankan cuisine bound with GLVs. Most GLVs are naturally

growing and cultivated in rural areas. These rural growing GLVs are mostly used by urban and rural peoples. As a condiment; curry leaves (*Murraya koenigii*) and rampe (*Pandanus amaryllifolius*) are used in daily cooking. As a preparation of “kola kenda” (Green Leaves Porridge); *hatawariya* (*Asparagus racemosus*), *walpinalla* (*Cardiospermum halicacabum*), curry pincha (*Murraya koenigii*), etc are used. Most of the Sri Lankan people drink this porridge before breakfast early in the morning, which are prepared in home or selling in street at small boutique. Because they people knew the value of the GLVs and its medicinal properties. Nowadays, Sri Lankan people give more priority to boost their immunity to eat GLVs with the provoke of novel coronavirus disease (COVID-19) pandemic.

Nutritional importance of green leafy vegetables

GLVs are virtuous sources of minerals like iron, potassium and magnesium and vitamins of B, C, E and K. and also GLVs are good sources of soluble dietary fiber content. Consumption of higher in reduced risk of cardiovascular disease and possibly, colon cancer. There are any bioactive compounds presented in most of the GLVs. Viz; vitamins phenolic compounds, phytoestrogens, minerals etc.

Phenolic compounds of GLVs are considered secondary plant metabolites with different chemical and activities. Phenolic compositions improve the antioxidants activity. These are improved redox status of hepatic glutathione in rat models suffering from colon cancer.

GLVs contain high content of vitamins in male and female non-smoking diseases daily intake of 90-100mg vitamin C reduces the risk many diseases especially cardiovascular problems. Vitamin E plays a major part in prevention of LDL oxidation, inhibition of monocyte-endothelia adhesion, inhibition of monocyte reactive oxygen species and inhibit the platelet adhesion.⁴

The high level of vitamin K of GLVs produces osteocalcin which reduces the hip-fracture in middle-aged people. GLVs which are rich in vitamin A content. Consumption of GLVs is prevent the xerophthalmia which is due to severe vitamin A deficiency causes pathological of conjunctiva and cornea. Vitamin A rich GLVs shows to significant decrease of breast and skin cancer. GLVs are rich in iron and calcium. Zinc contain GLVs are involved in normal functioning of immune system.

Commonly used green leaf vegetables in Sri Lanka culinary

Alternanthera sessilis (Figure 1)

Sinhala name: Mukunuwenna

Tamil name: Ponnankanni

English name: Sessile joy weed



Figure 1 *Alternanthera sessilis*.

It is an aquatic plant known by several names. It is consumed as a green leaf vegetable specially in each and every Sri Lankan and some Asian countries cuisines. It is a perennial herb often found in and near ponds, canals and water reservoirs. Shoots and tender leaves are often eaten as vegetable.

In Sri Lanka cuisine it is cooked as in the form of “Mellum” (type of curry). And also used to prepare the “Kola Kenda” *Alternanthera sessile* leaves containing bioactive compounds such as antioxidants, phenolic compounds, Vitamin A, E and K and oleanolic acid. The plant is said to abortifacient, cholagogue, febrifuge and galactagogue. It is eaten by nursing mothers who wish to increase their milk flow. The plant is to treat hepatitis with other medicinal plants. The plant paste is applied as a poultice on wounds.^{5,6} *Alternanthera sessile* has many medicinal actions, viz; hepatoprotective, antioxidant, blood purifier, anti-inflammatory, febrifuge, haematinic, wound healing properties and relaxing smooth muscles.⁷

Trianthema portulacastrus (Figure 2 & 3)

Sinhala name: Maha saarana

Tamil name: Saaranai

English name: Horse purslane

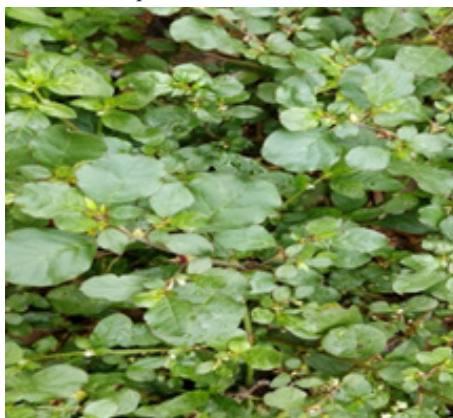


Figure 2 *Trianthema portulacastrus*.



Figure 3 *Trianthema portulacastrus* curry with coconut milk.

T. portulacastrum is a perpetual depending on structural area and the plant is proliferated by seeds and stem can be spread by cuttings very easily. The plant is often luscious, annual terrestrial and prostrate herb.⁸ *Trianthema portulacastrum* L. contains an extensive variety of carbohydrates, fats, tannins, terpenoides, flavonoides, steroids, alkaloids, saponins, cinnamic acid derivatives and benzoic acid results of secondary metabolites.^{9,10} In Sri Lankan cuisine it is consumed with lentils, dhal or cooked alone with coconut milk. This plant has anti-inflammatory, hepatoprotective, diuretic, antipyretic, antioxidant and anti-hyperglycaemic effects.^{11,12}

Recently it is recommended strongly for consumption of nutraceuticals to improve health, prevent and treat diseases. Leaves used in edema and dropsy as a diuretic. Leaves decoction is used as an antidote for alcoholic poison. Due to diuretic action of the leaves it has been useful in the treatment of edema and ascites.¹³

Ipomoea aquatic (Figure 4 & 5)

Sinhala name: Kankoon

Tamil name: Vallal

English name: Water spinach



Figure 4 *Ipomoea aquatic*.

It is most commonly grown-up in Southeast, East and South Asia. It is used extensively in Sri Lankan, Indonesian, Burmese, Thai and Chinese cuisine. In Sri Lanka mainly cooked as in the name of “Kankung Thel Dala” (Water Spinach stir fry) *Ipomoea aquatic* is a perpetual glabrous herb having elongated, flat, hollow stem. Leaves are long and broad, acute, heart-shaped or hastate with rounded or

acute lobes, and having 3.8-12.5cm long petiole.¹⁴ *I. aquatica* leaves contain more moisture content, carbohydrate, protein, fat, fiber, mineral, nicotinic acid, riboflavin, vitamin C, and vitamin E.^{14,15}



Figure 5 Water spinach stir fry.

In Unani system of medicine *I. aquatica* leaves extract are used as carminative agent and lessens inflammation, and is useful in fever, jaundice, biliousness, bronchitis, and liver complaints and used in nervous and general debility of female. The whole plant is used in leukoderma also.¹⁶

Sesbania grandiflora (Figure 6 & 7)

Sinhala name: Kathurumunga

Tamil name: Agatti keerai

English name: Swamp pea



Figure 6 *Sesbania grandiflora*.



Figure 7 Malluma.

It is inherent to humid Asia and is extensive in Sri Lanka, India and Malaysia. This tree is commonly found in the backyard of many Sri Lankan houses. *Sesbania grandiflora* L. is a small straight, strong-growing, and thinly branched tree that reaches 10m in height. *Sesbania* species have pinnately compound leaves where each leaf is divided into multiple leaflets.¹⁷ In Sri Lanka it is consumed in raw form as “Sambol” and cooked as “Malluma”. It contains alkaloids, tannins, flavonoids and anthroquinone.¹⁸ Studies showed that, *Sesbania grandiflora* leaves possess antioxidant, antiuroithiatic, anticonvulsive, anti-inflammatory, antibacterial and anxiolytic activity.¹⁹ Leaves of *Sesbania grandiflora* used as a medication for thrombosis, diarrhoea and inflammatory diseases and against few important bacterial pathogens.²⁰ In case of nasal catarrh, the leaf juice was used. Leaves are crushed and used to purify mouth and throat and are useful in stomatalgia. The leaf extract may prevent the formation of advanced glycation end products.^{21,22}

Moringa oleifera (Figure 8 & 9)

Sinhala name: Murunga

Tamil name: Murungai

English name: Drumstick tree



Figure 8 *Moringa oleifera*.



Figure 9 Malluma.

Moringa oleifera Lam. is a tree that grows extensively in many humid and subtropical countries. It is grown commercially in Sri Lanka, India South and Central America and Africa, and throughout Asia and Southeast Asia. Due to high content of nutrition content, leaves are widely used as a basic food. Leaves are consumed as “Malluma” by Sri Lankans.²³ *Moringa oleifera* leaves are a great

muscle builder because it contains 30% of vegetable protein and 21 amino acids. It has a very high percentage of protein for a plant. The leaves of the *Moringa oleifera* are good source in minerals like Ca, K, Zn, Mg, iron and Cu. Leaves are highly content of vitamins like β -carotene of vitamin A, vitamin B, C, D and E. Further, in its leaves are contains phytochemicals such as tannins, sterols, flavonoids, saponins and alkaloids.²⁴ It is this protein that helps to build muscles in the body and maintain body mass. *M.oleifera* leaves contain a wide of antioxidants and other properties that help in fighting bacteria such as *Salmonella*, *E.coli* and others. Many research described that *M.oleifera* as extremely potent anti-inflammatory,²⁵ hepatoprotective,²⁶ antihypertensive²⁷ and anti-tumor.²⁸ Also, its seed has strong coagulative and antimicrobial properties.²⁹

M.oleifera have potent neuroprotectant. Its leaves have antioxidant property can diminish the reactive oxygen species, thereby protecting the brain in cerebral ischemia is caused due to obstruction of blood flow to the brain.³⁰

Leaves can be consumed fresh, cooked, or stored as desiccated powder for many months without refrigeration, and reportedly without loss of nutritional value. Moringa is especially gifted as a food source in the tropics because the tree is in full leaf at the end of the dry season when other foods are typically scarce.³¹ For treating malnutrition any Moringa leaf powder is effective. Eating of Moringa leaves powder result had indicated that children maintained or increased their weight and improved overall health, pregnant women recovered from anemia and had babies with higher birth weights and breast-feeding women increased their production of milk.³²

Dregea volubilis (Figure 10)

Sinhala name: Anguna kola

Tamil name: Kurinja ilai

English name: Green milk weed



Figure 10 *Dregea volubilis*.

This plant is extensively grown in India, Sri Lanka, Myanmar, Indonesia, Thailand, and China. It is a large twining shrub with a woody vine and its leaves are round or ovate, sharp at the base and tip, and rather leathery.³³ *D. volubilis*, different parts contain triterpenoids, glycosides, flavonoids, and phenolic compounds with several active substances in many classes.^{34,35} Recent reports show antimicrobial, anti-oxidant, anticancer, anti-diabetic, anti-inflammatory etc., activities in humans. In Sri Lanka, leaves are consumed as in the form of “*Melluma*” and Sambol.

Leaves have the action of increase milk production in nursing women, purify and detoxify blood.

Costus speciosus (Figure 11)

Sinhala name: Thebu

Tamil name: Kostam

English name: Creep ginger



Figure 11 *Costus speciosus*.

Costus speciosus grows in the humid and wet evergreen areas of the Indo-Malayan region and Sri Lanka. It is a luscious, straight, perpetual, decorative, herbaceous plant, root stock tuberous stem, sub-woody at the base, thick creeping rhizomes growing up to 2-2.7m height with long lanceolate leaves. This plant has been consumed as food in the form of “*Sambo*” and “*Mallum*” by Sri Lankans. Due to its diverse nature, it has been reported that it comprises plenty of phytochemicals of such as phenols, steroids, alkaloids, flavonoids, saponins and tannins.³⁶⁻³⁸ Recent research shows that, the plant has pharmacological properties like; anthelmintic, anti-inflammatory, antidiabetic, hepatoprotective, antihyperlipidemic, antispasmodic, and antimicrobial.³⁹ This plant has hypoglycemic effect due to existence of phenolic compounds shows. The root extract also has the hypoglycemic effect.^{40,41}

Cardiospermum halicacabum (Figure 12)

Sinhala Name: Walpinala

Tamil Name: Mudakkottan

English Name: Lesser balloon vine



Figure 12 *Cardiospermum halicacabum*.

Cardiospermum halicacabum is an yearly or perennial herbaceous climber about 200-400cm height and is found throughout tropical as well as subtropical regions of Asia and Africa, which is eat as a green vegetable in Sri Lanka.^{42,43} The leaves mainly used in preparing “*Kola kanda*” and Sambol in Sri Lankan cuisine mainly consumed in the purpose of to cure rheumatism. The plants have shown activities such as vaso depressant, antipyretic, antimalarial, antioxidant, antiulcer,

and suppress the production of TNF α in mononuclear cells of human blood, anti-inflammatory and LPS induced TNF α , COX 2 nitric oxide production.^{44,45} Recent research studies showed in the different extracts of the plant that have phytochemical presence of flavones, aglycones, triterpenoids, glycosides, carbohydrates, fatty acids and volatile esters.^{46,47}

Currently *Cardiospermum halicacabum* preparations are used for the treatment of inflammatory dermatitis, eczema and insect bites. For the ailments like diarrhoea, dysentery and headache; leaves and stalks are very good remedy.⁴⁸

Solanum trilobatum (Figure 13 & 14)

Sinhala name: Wal Thibbattu

Tamil name: Thuthuvalai

English name: Climbing Brinjal



Figure 13 *Solanum trilobatum*.



Figure 14 *Thovayal*.

Solanum trilobatum Linn is a thorny climber plant with blueish flower and grows as a ascending under shrub. It is important medicinal plants and mostly accessible in Sri Lanka and Southern India and has been used in herbal medicine to treat various diseases.⁴⁹ In Sri Lanka mainly it is consumed as Sambol and “*Thovayal*” Research studies on *S. trilobatum* leaves and stem reported that to possess antimutagenic, antimicrobial, antidiabetic, anti-inflammatory and anti-ulcerogenic properties. The leaf extracts are could be used to increase male fertility and to cure snake poison.⁵⁰

S. trilobatum have main alkaloids recognized in the alcoholic extract from leaves and stem parts and possess antimicrobial activity.⁵¹ This plant mainly good for cough and asthma and leaves have expectorant activity.

Kalanchoe pinnat /Bryophyllum pinnatum (Figure 15)

Sinhala name: Akkapanana

Tamil name: Rana kalli/Sathai karaichaan

English name: Life plant/Miracle leaf



Figure 15 *Kalanchoe pinnata / Bryophyllum pinnatum*.

Kalanchoe pinnata is a luscious plant distinctive for the abundance of small plantlets that form on the margins of its leaves even when the leaves have been removed from the plant. It owns various pharmacological abilities like antioxidant, anticancerous, antiproliferative, antimicrobial, antiviral, antiprotozoal, antileishmanial, anthelmintic, analgesic, nephroprotective, thrombolytic, haemoprotective and antihistamine properties.⁵²⁻⁵⁴ Bbryophyllol, bryophollone and bryophollenone are the three new constituents of fresh leaves of the plant. Three new compounds, bryophynol, two phenanthrene are also present.^{55,56}

Basella alba L Figure (Figure 16 & 17)

Sinhala name: Nivithi

Tamil name: Pasali

English name: Spinach



Figure 16 *Basella alba*.



Figure 17 *Basella alba* leaves cooked with red lentils.

It is an edible flowering plant. It is inherent to South and Western Asia. In Sri Lankan cuisine it is cooked as in the form of curry with coconut milk or red lentils. It is frequently known as Malabar spinach, Indian spinach, Ceylon spinach, vine spinach.⁵⁷ For cooking the leaves and stem of the plant are used. The plant is originate to be multipurpose in properties. It has been found to be a good basis of calcium, iron, vitamin A and vitamin C.⁵⁸ The plant has enormous probable in androgenic activity, antiulcer activity, antioxidant, cytotoxic and antibacterial activity, anti-inflammatory activity, central nervous system (CNS) depressant activity, nephroprotective and wound healing properties etc.⁵⁹ For habitual headaches; the leaves glutinous liquid and tender stalks is a popular remedy for this illness. For pregnant women and children, the leaves decoction is a good source of laxative.⁶⁰ In indigenous system of medicine it is suggested that leaves application to head about half an hour before bathing brings sound refreshing sleep.⁶¹

Sauropus andro-gynus (Figure 18)

Sinhala name: Mella dumkola

Tamil name: Thavasi keerai

English name: Sweet leaf



Figure 18 *Sauropus andro-gynus*.

Sauropus androgynus is an erect bush that can reach up to 5m in height. The leaves are egg-shaped or lance-shaped, measuring 2.0–7.5cm and obtuse or acute.⁶² It is popular GLVs in Sri Lankan cuisine where leaves are eaten as “Mellum” and cooked with eggs. *S. androgynus* reveals that confined sterols, resins, tannins, saponins, alkaloids, flavonoids, terpenoids, glycosides, phenols, catechol, cardiac glycosides, and acidic compounds. Pharmacological activities of *Sauropus androgynus* plant have anti-inflammatory, antioxidant too.^{63–66} Although *S. androgynus* holds high remedial abilities and plentiful ethnopharmacological usages, and unnecessary eating of *S. androgynus* is reported to be able to cause a fatal permanent pulmonary disease viz; bronchiolitis obliterans. The leaves are used as a medicine for coughs and to sooth the lungs as a tonic.⁶⁷

To relieve fever and treat urinary and eye problems leaves can be used. And also, for ear-ache the juice from its leaves was dropped into the ear. Further, leaves were used to increase lactation, to relieve cough, and to treat hypertension, diabetes, nose ulcer and eye ailments.⁶⁸

Amaranthus spinosus (Figure 19)

Sinhala name: Arai keerai

Tamil name: Mullu keerai

English name: Needle burr



Figure 19 *Amaranthus spinosus*.

This plant is grown throughout in India, Sri Lanka and spread throughout the tropics and warm temperate regions of Asia. It is an erect, perpetual grows up to 1m. Stem are terete or densely angular, glabrous or slightly young, green, reddish-brown, glabrous, and branched. The leaves alternative and are simple without stipules; petiole is approximately as long as the leaf blade.⁶⁹

It encompasses rich source in alkaloids, flavonoids, glycosides, phenolic acids, steroids, amino acids, terpenoids, lipids, saponin, betalain, b-sitosterol, stigmaterol, linoleic acid, rutin, catechuic tannins and carotenoids.⁷⁰ The research studies on *A. spinosus* have been reported that, it has antidiabetic, antitumor, analgesic, antimicrobial, anti-inflammatory, spasmolytic, bronchodilator, hepato-protective, spermatogenic, antifertility, antimalarial, antioxidant properties.⁷¹

To prevent swelling around stomach while the leaves are boiled without salt and to cure jaundice it can be consumed for 2–3days. Leaf infusion is used in anaemia as a diuretic. In Ayurveda the plant is used as febrifuge, antipyretic, laxative and diuretic. Also, its cuisine worth, it is a popular medicinal plant used to apparent for treat digestible, bronchitis, appetizer, nausea, galactagogue, haematinic, stomachic effects, nausea, flatulence, anorexia, blood diseases, burning sensation, leucorrhoea, leprosy, piles and as an action for illusion, healing of injuries and rheumatism, and to apprehension the coughing up of blood.^{72,73}

Lasia spinosa (Figure 20 & 21)

Sinhala name: Kohila leaves

Tamil name: - Koila

English name: Lasia



Figure 20 *Lasia spinose*.



Figure 21 Kohila dalu curry.

L. spinosa is a watery or terrestrial plant, short stemmed spiny heirs with underground rhizome that usually occurs in wet forests, wetlands. *L. spinosa* is a great marshland plant with the stem stout 1 m high and the leaves broadly arrow shaped in outlines, enormously divided into 4-6 pairs of narrow side lobes.⁷⁴ In Sri Lankan cuisine *L. spinosa* cooked with coconut milk named as “Kohila dalu curry”. In Sri Lanka, as a supplementary dish with staple food the tender leaves are used. The leaves and rhizomes liquid are given as a medicine to treat piles and fistula.⁷⁵ *L. spinosa* is one of such widely used plant in many Asian countries specially Sri Lanka. Report shows that it had a wide range of subordinate metabolites such as alkaloids, flavonoids, tannins, saponins and steroids.⁷⁶ leaves and stalks have demonstrated profound anthelmintic, anti-inflammatory, antioxidant, anticestode, and antinematode efficacy.⁷⁷⁻⁷⁹

Allium cepa L (Figure 22 & 23)

Sinhala Name: Lunu kola

Tamil Name: - Vengaya ilai

English Name: Onion leaves



Figure 22 Allium cepa.

Onion leaves are used as a leafy vegetable and consumed as a raw form like Sambol and also cooked with tomato.

It has antibacterial, antiseptic, anti-inflammatory, carminative, expectorant and hypoglycaemic activities.⁸⁰ Onion leaves is known to contain many vitamins and minerals and is rich in sulphur and aminoacids. Moreover, a variety of secondary metabolites, phytosterols and saponins has been identified.⁸¹



Figure 23 Salad.

Centella asiatica L (Figure 24 & 25)

Sinhala name: Gotu kola

Tamil name: Vallarai

English name: Indian pennywort



Figure 24 Centella asiatica.



Figure 25 Sambol.

It is a small shrub and the leaves are eatable and green in color, thin, alternative with long petioles, and quite characteristic reniform, orbicular with seven veins. In Sri Lankan cuisine *Centella asiatica* being the predominantly locally existing leafy green vegetable. In Sri

Lanka, plentiful food preparations are made from the pennywort. It is commonly used as a green salads vegetables called “*Sambo*”. And also, fresh juice grinded from whole plants, including roots is boiled with a minor quantity of rice and coconut milk to cook “*gotukola kenda*”, a thin porridge commonly used as a breakfast.⁸²

The main active constituents of CA are saponins include asiaticosides in which a trisaccharide moiety is linked to the aglycone asiatic acid, madecassoside and madasiatic acid which are supposed to be mostly thought to be for the wound healing and vascular effects.⁸³

Recent studies shows that it has pharmacological activities like; adaptogen, central nervous system relaxant, peripheral vasodilator, sedative, antibiotic, detoxifier, blood-purifier, laxative, diuretic, emmenagogue. It is used for enlightening memory and for overpowering mental confusion, stress as a brain tonic. And also, used for determined skin diseases and leprosy. Raw leaves are eaten or plant decoction is drunk to treat hypertension.^{84,85} For the treatment of various ailments like asthma, skin disorders, ulcers and body aches, to refining memory, as a nervine tonic and in action of dropsy, elephantiasis, gastric catarrh, kidney troubles, leprosy, leucorrhoea and urethritis, in gentle health care, in treatment of abdominal illnesses used in traditional system of medicine for thousands of years.⁸⁶⁻⁸⁸

Murraya koenigii (Figure 26)

Sinhala name: Curry pincha

Tamil name: - Kariveppillai

English name: Curry leaves



Figure 26 *Murraya koenigii*.

Murraya koenigii has small plant which about 2.5 meters in height, the stem is dark green to brownish in color. The leaves are about 30cm long and have a reticulate venation.⁸⁹ The matured curry leaves consist much moisture, less protein, carbohydrate which is of total sugars and total ash 13.06%. The chemical constituents in curry leaves are oxalic acid, resin, carbazole alkaloids and the key bioactive products like; koenigin, bicyclomahanimbicine, cyclomahanimbicine, murrayastine, coumarine, koenidine and pypayafolinecarbazole has vital pharmacological actions and the major serving of volatile oil consist of bicyclomahanimbicine, mahanimbicine.⁹⁰

The pharmacological studies shows that curry leaves own antibacterial, antifungal, larvicidal, anticarcinogenic antioxidant, hypoglycemic, peroxidative, hypolipidemic anti-lipid and antihypertensive activity.⁹¹ Leaves are used for both medicinal and culinary purpose. There are highly fragrant and have a unique flavor with notes of citrus. *Murraya koenigii* were also used as additive mediators in curries and chutneys and also use as a blood purifier, tonic and cure for stomachache. The grounded curry leaves fine paste and mixed with buttermilk and consumed orally In case of stomach

ailments. By consuming the root of curry leaves as juice very good remedy for renal pain. To prevent the progression of cataract the fresh juice of curry leaves can be used. To provide black color of the hair and prevent the premature greying of the hair the curry leaves can be used as internally and externally.^{92,93}

Maniot esculenta (Figure 27 & 28)

Sinhala name: Myokka kola

Tamil name: Maravalli ilai

English name: Manioc leaves



Figure 27 *Maniot esculenta*.



Figure 28 *Thovayal*.

It is a tall semi-woody perpetual tree, which can grow up to 7m high, having single to few stems and branched. Leaves are dark green and sometimes variegated and pedicels are light green to red.⁹⁴ It contains many antioxidants. Moreover, plant also comprises vitamin C, vitamin A, anthocyanins, saponins, steroids and glycosides.⁹⁵ Leaves can be used as a remedy to counter to several illnesses, such as rheumatism, fever, headache, diarrhea and loss of appetite. Leaves of this plant also apparently have shown antihemorrhoid, anti-inflammatory therefore, can use in all types of rheumatism.⁹⁶ Various research and literature shows it have stated many uses of this plant like the leaves can be used as a styptic, while the yam starch mixed with rum has been used as good remedy for skin problems, especially for children.⁹⁷

Conclusion

Green leafy vegetables provide vivacious nutrients required for human health. Being rich in essential micronutrients the green leafy vegetables can be used for the purpose of augmentation of nutritional deficient products. These include fiber, vitamins, minerals and amino acids. In Sri Lanka green leafy vegetables play an important role as nutritional source, and it is available around the year. It is considered as the cheapest source and has significant socioeconomic benefits. Further, it is also used as medicinal plants in various indigenous

settings to treat various diseases. This present review has shown that the green leafy vegetables have widely used in Sri Lankan cuisine and may contribute greatly towards to acquire the nutritional needs for human growth and protection against several ailments.

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Conflicts of interest

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References

- Kuhnlein HV, Recheverre O. Dietary change and traditional food systems of indigenous peoples. *Annu Rev Nutr.* 1996;16:417-442.
- World Health Organization (WHO) FAO. Launched report in, 2003. Geneva: World Health Organization; 2003.
- Nwanekezie EC, Obiakor-Okeke PN. Mineral Content of Five Tropical Leafy Vegetables and Effect of Holding Methods and Time. *American Journal of Experimental Agriculture.* 2014;4(12):1708-1717.
- Carr AC, Frei B. Toward a new recommended dietary allowance for vitamin C based on antioxidant and health effects in humans. *Am J Clin Nutr.* 1999;69(6):1086-1107.
- Rajiv Gupta, Hemant Kumar Singh. Nootropic potential of *Alternanthera sessilis* and *Clerodendrum fortuneatum* leaves on mice. *Asian Pacific Journal of Tropical Disease.* 2012;4:65-470.
- Muthaliari. M, Siddha. 1998. *Materia Medica (Vegetable section)*, Volume I, 4th edition, Publisher; 1988, Tamilnadu Siddha Medical Council, Chennai.
- Balachandar Balakrishnan, Jayachitra Ayyavoo, Paramasivam Sadayan, Arulkumar Abimannan. Evaluation of Antioxidant Activity of *Clitoria ternatea* and *Alternanthera sessilis* Plant Extracts Using Model System for Yeast Cells. *African Journal of Basic & Applied Sciences.* 2013;5(3):134-138.
- Anonymous. *The Wealth of India, Niscom, Raw Materials and Industrial Products*, National Institute of Science Communication, CSIR, 1976; Vol. V: 281-283. 3
- Nawaz HR, Malik A, Ali MS, Trianthemol: an antifungal tetraterpenoid from *Trianthema portulacastrum* L. (Aizoaceae). *Phytochemistry.* 2001; 56: 99.
- Asif M, Atif M, Malik ASA, Dan ZC, Ahmad I, Ahmad A. Diuretic activity of *Trianthema portulacastrum* L. crude extract in albino rats. *Trop J Pharm Res.* 2013; 12 :967.
- Balamurugan G, Jagan Mohan CM, Muthusamy P, Protective effect of *Trianthema portulacastrum* L. leaves on gentamicin induced nephrotoxicity in rats. *J Nat Remedies.* 2009; 9.
- Sunder SA, Reddy RNA, Rajeshwar Y, Kira NG, Prasad KD, Baburao B, et al. Protective effect of methanolic extract of *Trianthema portulacastrum* L. in atherosclerotic diet induced renal and hepatic changes in rats. *Der Pharm Lett.* 2010;2:540.
- Kumar A, Saluja AK, Shah UD, Mayavanshi AV, Pharmacological potential of *Albizia lebbbeck*: A review. *Pharmacogn Rev* 2007;1:171-175.
- Kirtikar KR, Basu BD. *Convolvulaceae*. *Indian Medicinal Plants*. 2nd ed., Vol. III. Delhi: International Book Distributors; 1993. 17245
- Anonymous. In: Sastri BN, editor. *Ipomoea*. *Wealth of India, Raw Materials*. Vol. 5. New Delhi: Council of Scientific and Industrial Research; 1959. p. 2378
- Jayaweera, DMA. *Medicinal Plants in Ceylon*. 1st Ed. Part-II. National Science Council, Colombo, 1982, Sri Lanka.
- Wagh V.D., et al, "Phytochemical, pharmacological and phytopharmaceutics aspects of *Sesbania grandiflora* (Hadga): A review", *Journal of Pharmacy Research.* 2009; 2 (5): 889-892.
- Outtara M.B., et al, "Antibacterial Potential and Antioxidant Activity of Polyphenols of *Sesbania grandiflora*", *Current Research Journal of Biological Sciences.* 2011; 3 (4) : 351-356.
- Gomase PV, Gomase T, Anjum S, Shakil S, Shahnavaj KM . *Sesbania grandiflora* Linn: a review on its ethnobotany, phytochemical and pharmacological profile. *Asian J Biomed Pharm Sci.* 2012; 2(12): 11-14.
- Binte Arfan N, Islam T, Sultana Julie A, Mohiuddin AK, Alam Khan S, et al. **Thrombolytic, Membrane stabilizing, Antidiarrhoeal and Antimicrobial Properties of Bioactive Compounds Isolated from leaves of *Sesbania grandiflora* Naturally Growing in Banglades. Iranian Journal of Pharmaceutical Sciences.** 2016; 12: 31-46.
- Nadkarni AK, *Indian Materia Medica*. Bombay Popular Prakashan, 2nd ed, 2009: 52-54
- Prasaana G, Saraswathi NT, The therapeutic role of *Sesbania grandiflora* as an inhibitor of advanced glycation end product (AGE) formation and the discovery of lead compounds for managing hyperglycemia. *Planta Medica.* 2013; 79(13):84.
- Mbikay 2012
- Kasolo JN et al. phytochemicals and uses of *M. oleifera* leaves in Uganda rural communities. *J. Med. Plants. Res.* 2010; 4: 753-757.
- Ezeamuzie IC, Ambadederomo AW, Shode FO, et al. Antiinflammatory Effects of *Moringa oleifera* Root Extract. *International Journal of Pharmacognosy.* 1996;34:207-212.
- Pari L, Kumar NA. Hepatoprotective activity of *Moringa oleifera* on antitubercular drug-induced liver damage in rats. *J Med Food.* 2002;5(3):171-177.
- Faizi S, Siddiqui BS, Saleem R, et al. Fully acetylated carbonate and hypotensive thiocarbamate glycosides from *Moringa oleifera*. *Phytochemistry.* 1995;38(4):957-963.
- Murakami A, Kitazono Y, Jiwajinda S, et al. Niaziminin, a thiocarbamate from the leaves of *Moringa oleifera*, holds a strict structural requirement for inhibition of tumorpromoter- induced Epstein-Barr virus activation. *Planta Med.* 1998;64(4):319-323.
- Eilert U, Wolters B, Nahrstedt A. The antibiotic principle of seeds of *Moringa oleifera* and *Moringa stenopetala*. *Planta Med.* 1981;42(1):55-61.
- Kirisattayakul W, Wattananthorn J, Tong-Un T, et al. Cerebroprotective effect of *Moringa oleifera* against focal ischemia stroke induced by middle cerebral artery occlusion. *Oxid Med Cell Longev.* 2013:1013.
- Fuglie, Lowell J. *The Miracle Tree: Moringa oleifera: Natural Nutrition for the Tropics*. Training Manual. Dakar, Senegal: Church World Service; 2001.
- Sambou DB. *Supplementation for pregnant and breast-feeding women with Moringa oleifera powder*. Development Potential for *Moringa* Products. Tanzania: International Workshop, Dares Salaam; 2001.
- Biswas M, Bhattacharya S, Mukhopadhyay R, et al. *Dregea volubilis* (L.f.) Benth. (Asclepiadaceae): An appraisal on pharmacognostic, phytochemical and pharmacological studies. *Orient Pharm Exp Med.* 2018;18:1-8.
- Sahu N, Panda, N, Mandal NB, et al. Polyoxypregnane glycosides from the flowers of *Dregea volubilis*. *Phytochemistry.* 2002;61(4):383-388.

35. Panda N, Mandal D, Mandal NB, et al. Flavonoid and flavone C-glycosides from *Dregea volubilis*. *Nat Prod Commun*. 2006;1:731–733.
36. Srivastava S, Singh P, Mishra G, et al. *Costus speciosus* (Keukand)-A Review. *Der Pharmacia Sinica*. 2011;2(1):118-128.
37. EL – far AH, Abou – Ghanema II. Biochemical and hematological evaluation of *Costus speciosus* as a dietary supplement to Egyptian buffaloes. *African Journal of Pharmacy and Pharmacology*. 2013;7(42):2774-2779.
38. Choudhury N, Chandra KJ, Ansarul H. Effect of *Costus speciosus* Koen on reproductive organs of female albino mice. *International Research Journal of Pharmacy*. 2012;3(4):200-202.
39. Saraf A. Phytochemical and antimicrobial studies of medicinal plant *costus Speciosus* (Koen.). *Chem*. 2010;7:S405S413.
40. Eliza J, Daisy P, Ignacimuthu S, et al. Antidiabetic and antilipidemic effect of eremanthin from *Costus speciosus* (Koen.) Sm., in STZ-induced diabetic rats. *Chem Biol Interact*. 2009;182:67–72.
41. Pawar V, Pawar P. *Costus speciosus*: An Important Medicinal Plant. *International Journal of Science and Research*. 2014;3(7):28–33.
42. Huang MH, Huang SS, Wang BS, et al. Antioxidant and anti-inflammatory properties of *Cardiospermum halicacabum* and its reference compounds *ex vivo* and *in vivo*. *J Ethnopharmacol*. 2011;133(2):743-750.
43. KC VB, Krishnakumari S. *Cardiospermum halicacabum* suppresses the production of TNF-alpha and nitric oxide by human peripheral blood mononuclear cells. *African Journal of Biomedical Research*. 2006;9(2):95-99.
44. Sheeba MS, Asha VV. *Cardiospermum halicacabum* ethanol extract inhibits LPS induced COX-2, TNF- α and iNOS expression, which is mediated by NF- κ B regulation, in RAW264. 7 cells. *J Ethnopharmacol*. 2009;124(1):39-44.
45. Thabrew I, Munasinghe J, Chackrewarthy S, et al. The effects of *Cassia auriculata* and *Cardiospermum halicacabum* teas on the steady state blood level and toxicity of carbamazepine. *J Ethnopharmacol*. 2004;90(1):145-150.
46. Hopkins CY, Ewing DF, Chiosholm MJ. A short chain ester from seed oil of *Cardiospermum halicacabum* Linn. *Phytochemistry*. 1968;7:619–624.
47. Ferrara I, Schettino O, Motesano D. Triterpenoids from *Cardiospermum halicacabum* Linn. *Phytother Res*. 1996;10(Suppl 1):S192–S194.
48. Patil Ag, Joshi KA, Patil DA, Chandra N. Pharmacological standardization of stem. *Res J Pharm Biol Chem Sci*. 2011;2. Supp 2:343-352.
49. Ramakrishna S, Ramana KV, Mihira V, et al. *Res J Pharma Biol Chem Sci*. 2011;2(1):701–705.
50. Kumar SRS, Priya LC, Rao KVB. Phytochemic Composition, Antimicrobial and Haemolytic Activity of *Solanum trilobatum* Lin. *Pharmacologyonline Newsletter*. 3:1336-1341.
51. Kirthikar Basu BD. *Indian Medicinal Plants*. Dehradun: IBD; 2005.
52. Bisswas SK, Chowdhury A, Das J, et al. Assessment of cytotoxicity and antibacterial activities of ethanolic extracts of *Kalanchoe pinnata* linn. (Family: crassulaceae) leaves and stems. *International Journal of Pharmaceutical science and Research*. 2011;2(10):2605-2609.
53. Nassis CZ, Haebisch EM, Giesbrecht AM. Antihistamine activity of *Bryophyllum calycinum*. *Braz J Med Biol Res*. 1992; 25:929-936.
54. Rossi-Bergmann B, Costa SS, Borges MBS, da Silva SA, Noletto GR, Souza MLM et al. Immunosuppressive effect of the aqueous extract of *Kalanchoe pinnata* in mice. *Phytotherapy Research*. 1994; 8(7):399-402.
55. Siddiqui S, Faizi S, Siddiqui BS. Triterpenoids and phenanthrenes from leaves of *Bryophyllum pinnatum*. *Phytochemistry*. 1989; 28(9):2433-2438
56. Okwu DE, Nnamdi FU. Two novel flavonoids from *Bryophyllum pinnatum* and their antimicrobial Activity. *J. Chem. Pharm. Res.*2011; 3(2):1-10
57. Roy SK, Gangopadhyay G, Mukherjee KK. Is stem twining form of *Basella alba* L. a naturally occurring variant?. *Current Science*, 2010; 98: 1370-1375
58. Palada MC, Chang LC (2003). International Co-operators guide: “Suggested cultural practices for *Basella*”, Asian vegetable research and development centre. (AVRDC News letter).
59. Anandarajagopal K, Sudhahar D, Ajaykumar TV, et al. Evaluation of CNS Depressant Activity of Aerial Parts of *Basella alba* Linn. *IJPI'S Journal of Pharmacology and Toxicology*. 2011;1:5.
60. Rathee S, Ahuja D, Rathee P, et al. Cytotoxic and antibacterial activity of *Basella alba* whole plant: A relatively unexplored plant. *Pharmacologyonline*. 2010;3:651-658.
61. Panda H. *Handbook on medicinal herbs with uses*. Delhi, India: Asia Pacific Business Press; 2004. pp. 178-179.
62. Li PT, Chiu H, Ma J, et al. Euphorbiaceae, in *Flora of China II*. In: Wu ZY, Rave PH, Hong DY, Editors. USA: Missouri Botanical Garden Press; 2008. pp. 163–314.
63. Madhu CS, Manukumar HMG, Basavaraju P. New-vista in finding antioxidant and anti-inflammatory property of crude protein extract from *Sauropus androgynus* leaf. *Acta Sci Pol Technol Aliment*. 2014;13(4):375-383.
64. Gayathamma K, Pavani KV, Raji R. Chemical constituents and antimicrobial activities of certain plant parts of *Sauropus androgynus* L. *International Journal of Pharma and Bio Sciences*. 2012;3(2):561–566.
65. Soka S, Alam H, Boenjamin N, et al. Effect of *Sauropus androgynus* leaf extracts on the expression of prolactin and oxytocin genes in lactating BALB/C Mice. *Journal of Nutrigenetics and Nutrigenomics*. 2010;3(1):31–36.
66. Sai KS, Srividya N. Blood glucose lowering effect of the leaves of *Tinospora cordifolia* and *Sauropus androgynus* in diabetic subjects. *Journal of Natural Remedies*. 2002;2(1):28–32.
67. Hamidun B, Bunawan SN, Baharum SN, et al. *Sauropus androgynus* (L.) Merr. induced bronchiolitis obliterans: from botanical studies to toxicology. *Evid-Based Compl Alt Med*. 2015;1-7.
68. Madhu CS, Manukumar HMG, Basavaraju P. New-vista in finding antioxidant and anti-inflammatory property of crude protein extract from *Sauropus androgynus* leaf. *Acta Sci Pol Technol Aliment*. 2014;13(4):375-383.
69. Oya GN, Uygur FN. A New Record for the Flora of Turkey *Amaranthus spinosus* L. (Amaranthaceae). *Turk J Bot*. 2000;24:359-360.
70. Jamaluddin ATM, Qais N, Ali MA, et al. Analgesic activity of extracts of the whole plant of *Amaranthus spinosus* Linn. *Int J of Drug Dev and Res*. 2011;3(4):189-193.
71. Reyad-ul-Ferdous M, Shamim Shahjahan DM, Tanvir S, et al. Present Biological Status of Potential Medicinal Plant of *Amaranthus viridis*: A Comprehensive Review. *American J Clinical Exp Med*. 2015;3:12–17.
72. Mishra SB, Verma A, Mukerjee A, et al. *Amaranthus spinosus* L. (Amaranthaceae) leaf extract attenuates streptozotocin-nicotinamide induced diabetes and oxidative stress in albino rats. A histopathological analysis. *Asian Pacific J of Trop Biomed*. 2012;1647-1652.
73. Ghosh D, Mitra P, Ghosh T, et al. Antipeptic ulcer activity of the leaves of *Amaranthus spinosus* L. in rats. *Mintage J of Pharm and Med Sci*. 2013;2(3):52-53.

74. Lakshmi MA, Priya GV, Rao BG. Morpho-anatomical feature and phytochemical assessments of *Lasia spinosa* (L.)Thwaites. *Indian Journal of Pharmaceutical Sciences*. 2020;82(5):891–901.
75. Jayaweera. Medicinal Plants. (Indigenous and toxic) used in Ceylon. Part-I. India: National Science Council of Sri Lanka; 1981.134-135
76. Brhma J, Chkravarthy S, Rethy P. Qualitative estimation of the presence of bioactive and nutritional compounds in *L. spinosa*: An important vegetable plant used by the Bodos of Kokrajhar District. *Int J Res Chem Tech*. 2014;6(2):1405-1412.
77. Goshwami D, Rahman MM, Muhit MA, et al. Antioxidant property, cytotoxicity and antimicrobial activity of *Lasia spinosa* leaves. *Nepal Journal of Science and Technology*. 2013;13(2):215–218.
78. Scheau C, Caruntu C, Badarau IA., et al. Cannabinoids and inflammations of the gut-lung-skin barrier. *Journal of Personalized Medicine*. 2021;11(6):494.
79. Deb D, Dev S, Das AK, et al. Antinociceptive, antiinflammatory and anti-diarrheal activities of the hydroalcoholic extract of *Lasia spinosa* Linn. (Araceae) roots. *The American Journal of Pharmacy*. 2010;29(8):1269–1276.
80. Kumar KPS, Bhowmik D, Tiwari P. *Allium cepa*: A traditional medicinal herb and its health benefits. *Journal of Chemical and Pharmaceutical Research*. 2010;2(1):283–291.
81. Griffiths G, Trueman L, Crowther T, et al. Onions-A global benefit to health. *Phytotherapy Res*. 2002;16(7):603-615.
82. Chopra RN, Nayar SL, Chopra IC. Glossary of Indian Medicinal Plants (Including the Supplement). New Delhi, India: Council of Scientific and Industrial Research; 1986.
83. Roy DC, Barman SK, Shaik MM. Current updates on *Centella asiatica*: Phytochemistry, pharmacology and traditional uses. *Med Plant Res* 2013;3(4):70-7
84. Singh RH, Narsimhamurthy K, Singh G. Neuronutrient impact of Ayurvedic Rasayana therapy in brain aging. *Biogerontology*. 2008;9(6):369-374.
85. Subathra M, Shila S, Devi MA, et al. Emerging role of *Centella asiatica* in improving age-related neurological antioxidant status. *Exp Gerontol*. 2005;40(8-9):707-715.
86. Babu TD, Kuttan G, Padikkala J. Cytotoxic and anti-tumour properties of certain taxa of Umbelliferae with special reference to *Centella asiatica* (L.) Urban. *J Ethnopharmacol*. 1995;48(1):53-57.
87. Suguna L, Sivakumar P, Chandrakasan G. Effect of *Centella asiatica* extract on dermal wound healing in rats. *Indian J Exp Biol*. 1996;34(12):1208-1211.
88. Zainol MK, Abd-Hamid A, Yusof S, et al. Anti-oxidant activity and total phenolic compounds of leaf, root and petiole of four accessions of *Centella asiatica* (L.) Urban. *Food Chem*. 2003;81(4):575-581.
89. Singh S, More PK, Mohan SM. Curry leaves (*Murraya koenigii* Linn. Sprengal)-a miracle plant. *Indian J Sci Res*. 2014;4(1):46-52.
90. Ganesan P, Phaiphon A, Murugan Y, et al. Comparative study of bioactive compounds in curry and coriander leaves: An update. *Journal of Chemical and Pharmaceutical Research*. 2013;5(11):590-594.
91. Iyer D, Uma DP. Phyto-pharmacology of *Murraya koenigii*. *Pharmacognosy Reviews*. 2008;2:180-184.
92. Sindhu RK, Arora S, Evaluation of phenolic contents and antioxidant potential of *Murraya koenigii* (L) spreng roots. *Journal of Applied Pharmaceutical Science*. 2012;2(11):120-122.
93. Parul S, Javed A, Neha B, Honey J, Anuj B., Curry leaves- A medicinal herb. *Asian J Pharm Res*. 2012;2(2):51-53.
94. Fasuyi AO. Nutrient composition and processing effects on cassava leaf (*Manihot esculenta* Crantz) antinutrients. *Pakistan J Nutr*. 2005;4:37-42.
95. Okeke CU, Iweala E. Antioxidant profile of *Dioscorea Rotundata*, *Manihot Esculenta*, *Ipoemea Batatas*, *Vernonia Amygdalina* and *Aloe Vera*. *J Med Res Technol*. 2007;4:4- 10
96. Popoola TOS, Yangomodou OD, Akintokun AK. Antimicrobial activity of cassava seed oil on skin pathogenic microorganism. *Res J Med Plant*. 2007;1:60-64.
97. <http://www.sacredearth.com/ethnobotany/plantprofiles/cassava.php>