ISSN-2249-5746
International Journal Of Ayurvedic And Herbal Medicine 2:3 (2012)469:476
Journal Homepage http://interscience.org.uk/index.php/ijahm

Phytonutrient Profile, Health Benefits and Culinary Applications of Selected Edible Foliages

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Phytonutients/phytochemicals are numerous and are highly beneficial to health, protecting our body against various diseases. There are many edible green leaves in our country which can be used in a myriad of ways in Indian cooking which not only offer protection but also cure several ailments.

Introduction

Phytonutrients also known as phytochemicals are the nutrients often concentrated in the skin of many fruits and vegetables, and are responsible for their colour, hue, scent and flavour (Lipman, 2010). Phytochemicals are biologically active compounds that occur naturally in plants. They are the molecules responsible for the colour and organoleptic properties (Brown, 2001).

Phytochemicals are chemical compounds formed during the plant's normal metabolic processes. These chemicals are often referred to as "secondary metabolites" of which there are several classes including alkaloids, flavanoids, coumarins, glycosides, gums, polysaccharides, phenols, tannins, terpenes and terpenoids (Harborne,1973; Okwe,2004). Phytochemicals are present in a variety of plants utilized as important components of both human and animal diets. These include fruits, seeds, herbs and vegetables (Okwu.2005).

The phytochemical/ phytonutrient are natural bioactive compounds that work with nutrients and dietary fiber to protect against diseases. Pronounced "fight-o-chemicals", phytochemicals fight to protect our health. They can have complimentary and over lacking mechanism of action in the body, including antioxidant effects, modulation of detoxification enzyme, stimulation of the immune system, modulation of hormone metabolism, antibacterial and antiviral effects (vickids.tamu.edu/nutrition).

Phytochemicals are bioactive non nutrients plant compounds in fruits, vegetables, grains and other plant foods that have been linked to reducing the risk of major chronic diseases. It is estimated that >5000 individual phytochemicals have been identified in fruits, vegetables and grains, but a large percentage still remain unknown and need to be identified before we can fully understand the health benefits of phytochemicals in whole foods (Liu, 2003).

The phytonutrient content of plants are phenol, cadinene caryophyllene, di pentene, lauric, palmiticacids (essentialoil) girinibine, mahanibine, murrayanine, carotene, vitamin, muconicine and mahanimbidine. steroids, alkaloids, flavonoids, triterpenoids, tannins, saponins, quinine, coumarin, protein, vitamins, sugar , gums and can be obtained from any part of the plants like leaves, flowers, fruits, seeds, barks and roots. The major phytonutrients identified to have nutraceutical properties include terpenes, phytosterols, phenols and theols (Srilakshmi, 2003). Phytonutrients are classified by their chemical structure and categorized into families based on the similarities in their structures. The phenols, or polyphenols is one family that has received attention in the scientific literature. They include the anthocyanidins, which give blueberries and grapes their dark blue and purple color, and the catechins, found in tea and wine, which provide the bitter taste as well as
the tawny colouring in these foods (www.naturalnews. com)

Health Benefits of Phytonutrients

Phytonutrients, the chemicals that help plants defend against environmental challenges, such as damage from pests or ultraviolet light, appear to provide humans with protection as well. Mounting research shows

their effectiveness in preventing and treating a range of conditions including everything from cancer and heart disease to diabetes and high blood pressure (Arnell, 2011).

Phytonutrients in Curry Leaves (*Murraya koengii)*

Chemical Profile of Curry Leave

The research study by Mishra (2009) evaluated the antioxidant potential of *murraya koengii* leaves. Mahanimbine is a carbazole alkaloid present in leaves, stem bark and root of *Murraya koenigii* (Knolker and Reddy, 2002). The *Murraya* species has the richest source of carbazole alkaloids. Further, carbazole alkaloids has been reported for their various pharmacological activities such as anti-tumor, anti-viral, anti-inflammatory, anti-convulsant, diuretic and anti-oxidant activities (Dineshkumar et al., 2010).

Farooq (2005) has reported the chemical constituents of curry leaves to be koenimbine (fruits, leaves); cadinene caryophyllene, di pentene, lauric and palmitic acids (essential oil)girinibine, mahanibine, murrayanine, carotene, vitamin, muconicine and mahanimbidine. Reddi (2004) examined fresh curry leaves and reported that they contain alkaloids, cyclomahanimcine, mahanimcine, koenidine, mahanine, koenine, koenigine, scopoline, girinimbine, mahanimbine, iso mahanimbine and koengicine.

Health Benefits of Curry Leaves

Ayurveda mentions its use as a treatment for diabetes. Feeding of diet containing various doses of curry leaves (5, 10 and 15%) to normal rats for seven days as well as mild and moderate diabetic rats for five weeks showed varying hypoglycaemic and anti hyperglycaemic effects. Whole plants, leaves and root barks of curry leaves are antiemetic, carminative, stomachic and tonic; green leaves; infusion used as antidiarrhoel, antidysenteric and antiemetic; bruised and applied locally to eruption and poisonous bites; root-bark; relieves renal pain (Farooq, 2005).

The plant in general is a tonic, stomachic and carminative. The bark of the root is a stimulant, used externally to cure eruptions and venomous bites. Juice of roots is given to relieve renal pains, eaten raw as a cure for diarrhoea and dysentery. It is given as a febrifuge in snake bite (Acharya, 2008).

The leaves are given in diabetes (Kar et. al.,1999). The bark is used as an antivenin (Selvanayagam et.al.,1994). Leaves are used in scabies, wounds (Bhandary et.al.,1995), hypertension (Fakim et.al.,1996) pimples, rashes, itching, constipation, liver disorders, and weight loss (Kong et.al., 1986). The leaves stimulate digestive enzymes and are a good remedy for nausea and indigestion. The leaves are also good for hair growth and colour.

Culinary Application of Curry Leaves

Sandip (2006), shows that *Murraya koengii* is used as a spice and condiment in India and other tropical countries. Curry leaves are used in South Indian cuisine for flavouring dhal, *sambhar, rasam, kari* etc (Reshmi, 2012)**.** In the kitchen, the leaves are used for their warm, appetising aroma and subtle, spicy flavour with meat, sea food or vegetable *curries, chutneys*, pickles, coconut sauce, relishes, omelettes, marinades and stir fries. The curry leaf is an integral part of the South Indian cuisine and provides a typical flavour to all South Indian food. The leaf is used to temper lentil preparations, dry vegetables dishes, coconut milk based curries, meat and chicken preparations and cooling drinks made with yoghurt. Curry leaves are also made into chutneys which are delicious. A few sprigs of curry leaves can be added to buttermilk along with asafoetida (hing) and when consumed after a meal eases digestion.

Phytonutrients in Tulsi *(Ocimum sanctum)*

Chemical Profile of Tulsi

A herb found throughout India, up to an altitude of 1.800 m in the Himalayas and is cultivated in temples and gardens. According to Farooq (2005), tulsi leaves contain volatile oil (0.4-0.8%) chiefly eugenol (21%) and β-caryophyllene (37%), a number of sesquiterpenes and monoterpenes viz; bornyl acetate, a-elemene, methyleugenol, near.l, β-pinene, camphene, urosolic acid, campesterol, cholesterol, a-sitosterol and methyl esters of common fatty acids. *Ocimum sanctum* contain urosolic acid flavonoids such as apigenin, polyphenols, anthocyanins and luteolin, eugenol, thymol or sesquiterpene alcohols. Tulsi roots contain

alkaloids, glycosides, saponins and tannins. Leaves contain volatile oil and ascorbic acid. Essential oil consists of methyl clavicol, camphor, eugenol, b-caryophyllene, caryophyllene, camphene, a-pinene etc.

Health Benefits of Tulsi

The ethanol extract of *ocimum sanctum* has been shown to cause significant reduction of blood glucose level in normal, glucose fed hyerglycemic and streptozotocin induced diabetic rats (Bharat and Oli, 2006).

It is used in catarrh and bronchitis, applied to the skin ring worm and other cutaneous diseases. It is used in skin care and it acts as a stimulant. Tulsi oil is effective in skin care, it is a tonic, anti septic and given in psoriasis. It helps in minimizing the effects of aging of the skin, decreases dark spot, soothes sun burn and other skin afflictions. According to Miller and Miller (2003), tulsi provides significant antioxidant and free radical scavenging protection, reduces the cell and tissue damage caused by harmful rays of the sun, lowers fevers, protects against gastric ulcers, reduces dangerous blood sugar levels in diabetics and supports dental and periodontal health.

Tulsi is useful in treating eczema, psoriasis, stress, asthma, allergies, arthritis, liver disease and fever. It is said to have antioxidant, anti biotic and anti aging effects on the body, as well (Devries, 2010). According to Singh and Srivastava. (1996), tulsi leaves are anti inflammatory, anti stress, antiarthritic and antipyretic. The unique chemistry of tulsi is highly complex. Tulsi contains hundreds of beneficial compounds known as phytochemicals. Working together, these compounds possess strong antioxidant, antibacterial, antiviral, adaptogenic, and immune-enhancing properties that promote general health and support the body's natural defense against stress and diseases.

Culinary Application of Tulsi

Tulsi is a wonderful herb that has many culinary applications. It is used as food flavouring in confectionaries, baked food, pickles, soups, meat pies, fish, cheese, tomato cocktail. It is great in pesto, soups and salads and has been used as a delicate and flavour full in India.

For many benefits, tulsi is effective taken in daily dosages of grams of dried leaf or as a few cups of herbal tea. Tulsi Tea is often prepared singly, as a blend of tulsi varieties, or in combination with other herbs, spices, sweeteners, lemon or milk, for varying tastes and medicinal benefits. Combinations may include ginger, lemon grass, licorice, brahmi (gota kola) or other herbs, masala chai spices (such as cardamom, cinnamon,cloves and pepper) and regular black or greentea. Tulsi tea is prepared from fresh or dried leaf and served hot or cold (www.Chailounge.co.uk/other/Tulsi).

Phytonutrients in Manathakkali Leaves(*Solanum nigram*)

Chemical Profile of Manathakkali Leaves

Manathakkali leaves are rich sources of riboflavin, nicotinic acid and vitamin C, besides β-carotene and citric acid. The leaf contains riboflavin, niacin, β-carotene, citric acid, vitamin C along with minerals like calcium, phosphorus and iron. The chemical analysis of the leaf consists of 82.1 percent moisture, 5.9 percent protein, 2.1 percent minerals and 8.9 percent carbohydrates. The minerals and vitamins present in it include calcium, phosphorus, iron, riboflavin, niacin and vitamin C. Its calorific value is 68 (Asian Online Recipes.com, 2010). The plant and the fruit contain toxic alkaloid solanine and saponin (Deshpande, 2010).

Health Benefits of Manathakkali Leaves

The black nightshade is used as an important ingredient in several Indian medicines. It is a valuable cardiac tonic. It corrects disordered processes of nutrition by which the organism ingests, digests, absorbs, transports, utilizes and excretes food substances, and restores the normal function of the system. It also reduces excitement, irritation and pain. The leaves of the plant are mildly bitter, which becomes less pronounced after cooking. The fruits of the plant are of tonic value and serve as an effective laxative. They improve appetite. The plant is beneficial in the treatment of dropsy. It increases the secretion and discharge of urine. Either it can be used as decoction or as a vegetable in the treatment of this disease. An extract of the leaves and stem, in doses of 6 to 8 ml can also be taken. Manathakkali leaves are useful in fevers. A syrup of the vegetable can be given as a cooling drink. To induce copious perspiration, a hot infusion of 0.75

to 1.25 decigrams, of dried leaves can be used. The fruits of the plant can also be given with beneficial results in fevers (www.asianonlinerecipes.com/herbs.../black-nightshade.). The leaves are effective in the treatment of digestive disorders. The raw juice of the leaves can be used alone or mixed with other juices or liquids. It is used in stomach disorders like flatulence, peptic ulcers and colitis. An infusion of the plant is useful in dysentery and other stomach ailments. The plant helps in removing catarrhal matter and phlegm from the bronchial tubes in asthma patients. The fruits of the plant can also be used beneficially in treating asthma (Bakhru, 2008).

The plant is useful in chronic skin diseases. The juice can also be applied locally on the affected parts such as acne, eczema and psoriasis. As an anodyne or pain reliever, a decoction of the plant can be used for washing inflamed, irritated and painful parts of the body. A paste of the plant serves as a useful applicant over corrosive ulcers, pustules and suppurating syphilitic ulcers, severe burns, herpes and rheumatic joints. Green fruits of the plant can be ground and applied locally on ringworms with gratifying results. A juice or poultice of leaves can be effectively applied on eruptive skin diseases, whitlow and burns. Hot leaves can be applied with gratifying results over swollen and painful scortum and testicles. A juice or poultice of the leaves is an efficacious application over rheumatic and gouty joints, corrosive ulcers and tumors. A decoction of the leaves can be used to wash tumours and inflamed, irritated and painful parts or the body (Devarkar, 2011).

The plant is beneficial in the treatment of dropsy. It increases the secretion and discharge of urine. The leaves are effective in the treatment of digestive disorders and stomach disorders like flatulence, peptic ulcers and colitis. An infusion of the plant is often used in dysentery and other stomach ailments. The plant helps in expelling catarrhal matter and phlegm from the bronchial tubes, in asthma patients. A juice or poultice of the leaves serves an efficacious application over rheumatic and gouty joints, corrosive ulcers and tumours. Manathakkali leaves regulate nitric oxide (NO) production, which is an antitumour molecule produced in activated macrophages

The total alkaloids isolated from the medicinal herb manathakkali leaves inhibited the growth of human cervical carcinoma. It is used as a hepatoprotective and anti-inflammatory agent. The lipid-soluble extract of *S. nigrum* leaves possess antinociceptive, anti-inflammatory and anti-pyretic properties. offers antiulcer activity by blocking acid secretion through inhibition of H^+-K^+-ATPase and decrease of gastrin secretion. These further suggest that it possesses antiulcerogenic as well as ulcer healing properties, which might be due to its antisecretory activity (Sathianaraynan et al., 2009).

Culinary Applications of Manathakkali Leaves

Manathakkali leaves are popularly used as a vegetable. The leaves blend well with other greens and pulses. The juice of the leaves can be mixed with medium like coconut water, coconut milk, butter-milk, cow's milk and fruit juice (Deshpande, 2010).

Both leaves and berries are mainly used in South Indian cooking to make stir fry dish (varai) and gravy curries (vathal kulambu).The leaves have medicinal properties, and make it as green curry for a typical Sri Lankan lunch, The berries are cooked in hot and sour gravies, leaves with pulses etc and made into delicious dishes (www.petitchef.com, 2011). The extract of the leaves can be consumed as a soup with the addition of mild spices.

Phytonutrients in Ivy gourd Leaves *(Coccinia Indica)*

Chemical Profile of Ivy gourd Leaves

The aqueous extract of fresh leaves of ivy gourd exhibited anthraquinons in addition to alkaloids, carbohydrates, proteins and amino acids, tannin, saponins, flavonoids, phytosterol, triterpenes. cephalandrol A and cephalandrol B, sigma-7-en-3-one, taraxerone and taraxerol (Rastogi and Mehrotra, 1998).

According to Sutar et al. (2010), the extract of *coccinia indica* contains alkaloids, carbohydrates, glycosides, tannin, saponins, flavonoids and other phytoconstituents such as cephalandrol, lupeol, sigma-7-en-3-one, taraxerone and taraxerol.

Phytochemical screening of *coccinia grandis* reported the presence of saponin, cardenoloids, flavonoids and poly phenols which may be attributed to anti bacterial activity. Phenolic compounds are generally noted for their anti microbial activities (Evans, 1989).

Health Benefits of Ivy gourd Leaves

Coccinia indica herb lowers blood sugar levels by 20 percent in type 2 diabetics (Arulselvan and Subramanian, 2006). Dried extracts of coccinia indica were administered to diabetic patients for 6 weeks. These extracts restored the activities of enzyme lipoprotein lipase (lpl) that was reduced and glucose-6-phosphatase and lactate dehydrogenase, which were raised in untreated diabetics (Kamble et al.,1998).

According to Yadav et al. (2008) leaves extract of ivy gourd is effective against malarial parasites. Mosquitoes are the major vector for the transmission of malaria, dengue fever, yellow fever, filarisis etc. Ivy gourd leaf extract showed significant mutagenic effect on neurospora crassa fungus. Aqueous extracts of the leaves of ivy gourd showed noteworthy inhibition of growth and mutagenesis on neurospora crassa. The 50% methanolic extract of whole plant of ivy gourd, showed the strong free radicals scavenging activity almost same as that of ginseng. The study provides scientific support for the anti stress and free radical scavenging activity of *coccinia indica* extract and substantiates the traditional claims for the usage of *coccinia indica* in stress induced disorders.

Ivy gourd leaves are used for treating gonorrhoea. Roots are antiprotozoal, hypoglycaemic. Leaves are used in eruption of skin. Juice from leaves and roots are used for treating diabetic (Farooq 2005),

According to Gopalan and Artemis (2003) the roots and leaves of ivy gourd are used in the treatment of diabetes, skin infection and eruptions. The gourd works as a laxative and thus provides relief in stomach problems. The extract of leaves and fruits are used for making health tonics in South Asian countries. *Coccinia indica* helps in regulating body temperature during fever.

Culinary Applications of Ivy gourd Leaves

Gopalan and Artemis (2003) have published a large number of recipes making use of coccinia varieties. Ivy gourd is often compared to bitter melon and is popular in Indian cuisine. The fruit is often used for making '*sambhar*' which is a name for South Indian lentil based vegetable soup. The people of Thailand and Indonesia use the fruits and leaves of this gourd in many dishes. The production of the gourd is encouraged in Thailand due to their rich micro nutrient content. The gourd is used in making curries, stir-fries, boiled dishes and in mashed form as stuffing. *Coccinia indica* also known as kundru is used for making kundru dal which consist of chick peas cooked with coccinia indica. In India it is eaten as a curry, by deep frying it along with or without chilli and garlic giving it excellent taste. Stuffing it with masala and sauteing it; or boiling it first in a cooker and then frying it.

Conclusion

It is possible to get all the phytonutrients that we need from our daily diet by a judicious combination of fruits and vegetables. The fast-paced lifestyle and modern farming and processing methods make it difficult to take in all the nutrients that we need to maintain our bodies in optimum physical condition. A healthy diet is the single most important thing that can help our body to free from diseases.

The foliages (green leafy vegetables) have good potential for use in various recipes as they have excellent health benefits. Awareness about their benefits can be brought about by way of educating the public so that prevention and cure can be brought about in the most natural way.

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