



A HOT WAY LEADING TO HEALTHY STAY

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Article Received on: 02/04/12 Revised on: 11/05/12 Approved for publication: 28/05/12

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ABSTRACT

Green Chilli is the life and soul of all delicious Indian dishes. It has been cultivated for thousands of years. Green Chilli is a fruit of the flowering plant *Capsicum frutescens*. Unripe fruits are green in color. On ripening, they attain the red shade. Green Chilli forms an excellent combination of healthy ingredients and essential nutrients. It is a good source of vitamins (A, C, B, E and P), minerals (iron, magnesium and potassium), dietary fibers and macronutrients. Green Chilli is famous for its intense pungent taste, which is provided by its active constituent Capsaicin. Capsaicin is generally recognized as a powerful local stimulant with no narcotic effect. Apart from its traditional and culinary uses, its therapeutic and pharmacological actions are noteworthy. Medicinally, Green Chilli plays a prominent role as an immunity booster, anti-cancer, anti-ulcer, analgesic, anti-inflammatory, anti-epileptic and anti-hemorrhoidal agent. It is helpful in the management of burns, psoriasis and chronic migraine. It is also beneficial in heart disorders and diabetes.

KEYWORDS: *Capsicum frutescens*, Capsaicin, Pungent, Stimulant, Spice

INTRODUCTION

Green chilli makes an integral component of Indian, Thai and Mexican cuisine. It is frequently used as a spice and as a vegetable. It is a favorite item used in cooking for almost all savory dishes like curries, daals, breads and appetizers. Salads, pickles, sauces, chutneys and spicy snacks are almost incomplete without this green and small sized vegetable. Thus, it is heart and soul of numerous cuisines. Green chilli, botanically an edible fruit, belongs to Solanaceae family. Green Chilli is closely related to species *C. chinese* and *C. annuum*. It is famous for its intense bitterness and heat produced after its consumption, which aids digestion. It ranges in taste from mild and tingling to explosively hot. Large, fleshy varieties tend to be milder than small, thin-skinned ones. Capsaicin is the substance found in Green Chilli, which is responsible for its spicy and hot flavor. It provides ample of essential nutrients to those, who consume it. But everyone is not familiar with its myriad of health benefits. Green Chilli is a marvelous food, which is low in fat and cholesterol content but rich in fiber, vitamins and minerals. It is an excellent medicine and thermogenic agent. It helps in controlling fever, aids digestion and reduces LDL cholesterol levels. This potent hot fruit of *Capsicum frutescens* is commonly stored in bottles or as pickles / sauce form for its long-term benefits.

Five domesticated species are:

- C. frutescens*: The Tabasco
- C. chinese*: The Habanera
- C. baccatum*: The oldest archeological evidence 4500 years ago in Europe
- C. annuum*: Red Chili Pepper, Paprika
- C. pubescens*: Rocto, Locoto

HISTORY

According to archeologists, Capsicum was used as a food as long as 9,000 years ago in Mexico. Archeologists estimate that peppers were cultivated widely in Central and South America and were carried to Spain in 1493, till entire Europe became familiar with Chilli. Chili has been cultivated in these regions for more than seven thousand years. Green Chilli was first used as a decorative item and later as a foodstuff and medicine. In around 15th and 16th centuries chili peppers were introduced to the rest of the world. Capsicum was carried to Britain from India in 1548. Gerard mentioned that Chilli was cultivated in his time. The plant was described by Linnaeus under the name of *C. frutescens* proper. This species appeared in Miller's Garden Dictionary in 1771. Christopher Columbus encountered chilli on his explorations of the Caribbean Islands. Thus, chilli was brought back to Europe. There it was used as a substitute for black pepper, which was very expensive, since it had to be imported from Asia. L. T. Thresh in 1846 reported in a Pharmacy Journal that the pungent principle of chilli could be extracted in a crystalline state. It was Thresh, who named the active substance as Capsaicin. Chilli plants are now grown widely in all continents.

SYNONYMS OF GREEN CHILLI

Indian Synonyms

- Hindi:** Hari mirch
- Punjabi:** Mirch
- Marathi:** Mirchi
- Gujarati:** Marcha
- Kannada:** Mensina kai
- Tamil:** Milagay
- Assamese:** Bhojolok
- Malayalam:** Mulaku

Table 1: Botanical Classification of Green Chilli

Kingdom	Plantae –Plants
Subkingdom	Tracheobionta - Vascular plants
Super division	Spermatophyta - Seed plants
Division	Magnoliophyta - Flowering plants
Class	Magnoliopsida - Dicotyledons
Subclass	Asteridae
Order	Solanales
Family	Solanaceae - Nightshade or Potato family
Genus	CapsicumL. – peppers

VARIETIES OF GREEN CHILLI

The genus Capsicum consists of approximately 22 wild species.

Oriya:	Lanka
Sanskrit:	Ujjvala marichiphala
Bengali:	Lankamorich
Telugu:	Mirapa kaya
International Synonyms	
French:	Puvre de guinea
German:	Paprika
Spanish:	Pimenton
Korean:	Kochu
Chinese:	La jiao
Italian:	Peprone
Dutch:	Spanese peper
Arabic:	Filfil ahmar
English:	Green Chilli
Portuguese:	Pimento
Russian:	Struchkovy pyeret
Japanese:	Togarashi
Indonesian:	Lombok
Turkish:	Toz biber
Sinhala:	Rathu miris
Thai:	Prik chifa

WORLD-WIDE PRODUCTION OF CHILLIES

Indian scenario

India is the chief producer, consumer and exporter of chilli. Although chilli is cultivated in all Indian states, maximum chilli is produced in Andhra Pradesh followed by Karnataka, Orissa, West Bengal and Maharashtra. Guntur in Andhra Pradesh is known for hottest chillies.

World scenario

Asia stands at the top in producing 65.8% of world green chillies and pepper; followed by Europe, which stands 2nd contributing 12.1% and Africa 3rd with 9.5% of world production. European production is mainly of mild type of chilli.

Major producers:

India, China, Spain, Thailand, Mexico, USA, South Korea, Turkey, Ethiopia, Uganda, Kenya and Tanzania form the major producers of chilli.

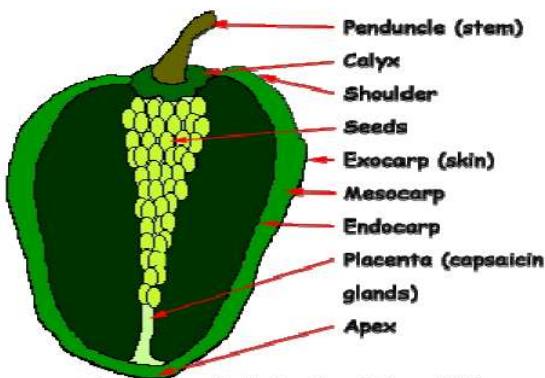


Figure 1: Longitudinal section of Green Chilli

CULTIVATION AND COLLECTION

Botanically Green Chilli is known as *Capsicum frutescens*. The capsaicin is concentrated in the placenta area. 60% of capsaicin is in the white pith and 40% in the seeds. The seeds are white or cream in color, circular or flat in shape. If one wants to have a less hot dish using green chillies, the top inch of the Chilli could be discarded, as that has the greatest concentration of capsaicin. Removal of seeds and veins reduces the intense hot taste. Green chilli is an immature fruits. Chilli plants are grown as ornamental plants in

different parts of the world. Selected examples are Black Pearl, Thai Ornamental, Numex Twilight, Marble and the Medusa pepper. It is a green plant, which produces multicolored fruits starting from purple, and then ripening to yellow, orange, and ultimately red.

Climate and soil: Chilli prefers warm and humid climate. Soils, which are basically light and well, drained, are best suited.

Transplanting, irrigation and fertilizer management: Transplanting has to be done, when the plant reaches the height of 15 to 20cm. It is always done in pairs. Maintaining spacing between rows is essential. Weed-free conditions should be maintained. Irrigation must be provided every day for up to 15 days after transplantation. Application of complex NPK fertilizer should also be done every 25 days.

Harvesting: Most chillies are grown as annuals and harvesting occurs about 3 months after planting. Flowering takes place 45 to 60 days after transplanting. Yield continues for about 3 months depending on cultivars and beneficial conditions. Harvesting tender green fruits for vegetable use should be done at initial stages.

Storage: Chillies should be crisp and bright, when purchased fresh and should have no spots that might go bad. When stored in a refrigerator, they last well for more than a week.



Figure 2: Flowering plant of Green Chilli



Figure 3: Green Chilli Fruit

COMPARITIVE ACCOUNT OF GREEN AND RED CHILLI

Green Chilli is beneficial in providing protection against development of cancers and ulcers. Red chilli, on the other hand enhances the risk of developing stomach ulcers and cancers of stomach, gall bladder, esophagus and liver. The risk of gastric cancer may be linked to the high consumption of red chilli. Researchers from Sungkyunkwan University, Korea, proposed that capsaicin altered the metabolism of chemical carcinogens. At higher doses, it may promote carcinogenesis, temporarily raise blood pressure and body temperature. Furthermore, Red chillies cause acidity, constipation as well as piles after a prolonged use. The Scoville heat units (SHU) for red chilli (4949.08) are also greater than Green Chilli (2216.58). Therefore, pungency of Red chilli is higher as comparison to its Green counterpart. Green color implies the presence of beta carotene, flavonoids, anti-oxidants and endorphins.

Table 2: Green Chilli versus Red Chilli

	Green chilli (100g)	Red chilli (100g)
Total Fat	0.2g	0.44g
Cholesterol	0mg	0mg
Sodium	7mg	9mg
Total carbohydrate	9.5g	8.81g
Dietary fiber	1.5g	1.5g
Sugars	5.1g	5.3g
Protein	2g	1.87g
Vitamin -C	404%	240%
Vitamin-A	24%	19%
Iron	7%	6%
Calcium	2%	1%
Capsaicin	138.5 µg/g	309.3 µg/g

CHEMICAL CONSTITUENTS

Green Chilli comprises of chemical constituents such as capsaicinoids, flavonoids, vitamins, minerals, carotenoids, steroids, steroidal glycosides, polyphenols and macronutrients.

Capsaicinoids

Capsaicin(oleoresin), dihydrocapsaicin, homocapsaicin I, homocapsaicin II, norcapsaicin, normoncapsaicin, homodihydrocapsaicin I, homodihydrocapsaicin II, nordihydrocapsaicin and normordihydrocapsaicin are different capsaicinoids present of Green Chilli¹. The active ingredient in a green chilli is called capsaicin, (8-methyl-N-vanillyl-6-nonenamide)², a phenolic compound related to vanillin, which gives the strong pungent taste to the capsicum. Of the capsaicinoid fraction, capsaicin (48.6%) is quantitatively followed by 6,7-dihydrocapsaicin (36%), nordihydrocapsaicin (7.4%), homodihydrocapsaicin (2%), and homocapsaicin (2%). Capsaicinoids and capsaicin are collectively found in amounts of 0.1% to 1%, with quantities varying according to soil and climate.

Flavonoids

Total flavonoids present in Green Chilli are 83.5 mg/kg of dry weight. They include myrecetin, luteolin, both flavones and flavonone glycoside conjugates³.

Vitamins

Green chilli is rich in vitamins A and C. Vitamin-C content of a Green Chilli is 6 times more than that of an orange fruit. Green chilli also contains vitamins B2 (Riboflavin), vitamin B6 (pyridoxine), niacin, folate and vitamin E. Recently, Russian scientists have identified vitamin-P in green chilli.

Minerals

Green chilli is a good source of potassium, manganese, iron and magnesium.

Essential amino acids

Tryptophan, lysine and phenylalanine are also found in Green Chilli.

Carotenoids

Green Chilli is rich in carotenoids¹. Some of the phytonutrients in Green Chili are alpha-carotene, beta-carotene, lutein and zeaxanthin.

Steroids and Steroidal Glycosides

Green Chilli has lanosterol and lanostenol as steroids. Capsicosides A, D and proto-degalactotigonin are steroidal glycosides¹present in Green Chilli

Polyphenols

Polyphenols obtained from Green Chilli (*Capsicum frutescens*) showed anti-oxidant and vasodilator effects⁴.

Macronutrients

A 1/2 cup of raw green chili peppers provides 1.5 g of protein, 0.15 g of fat, 7.1 g of carbohydrates and 1.1 g of fiber.

PHARMACOLOGICAL ACTIONS OF GREEN CHILLI

Natural pain killer

Capsaicin, the active ingredient of Green Chilli, acts as a selective agonist for the transient receptor potential vanilloid 1 (TRPV1) receptor present on afferent neurons⁵. These receptors are found to be responsible for analgesic effect. Topical capsaicin is recognized as a treatment for osteo-arthritic pain⁶. The analgesic effect can also result from the methoxyphenol portion of the capsaicin molecule, which is supposed to interfere with the lipooxygenase and cyclooxygenase pathways. Topically applied capsaicin, either as a cream or plaster, helps in reducing lower back pain⁷. Capsaicin plasters, when applied to relevant acupuncture points reduce the requirement for postoperative analgesia. It is also effective in the management of post-herpetic neuralgia⁸, bladder pain⁹, trigeminal neuralgia, fibromyalgia and diabetic neuralgia. Capsaicin has shown potential benefits in managing headaches, including cluster and migraine headaches¹⁰. It is also found to treat the pain associated with cancer¹¹.

Mechanism of action: Capsaicin acts on TRPV1 receptors. This receptor is a non-selective, ligand-operated cationic channel located primarily in the small fibers of nociceptive neurons. It is also broadly distributed in tissues of the brain, bladder, kidneys, intestines, keratinocytes of epidermis, glial cells, liver, and polymorphonuclear granulocytes, mast cells, and macrophages. This channel can be regulated and activated by endogenously released endovanilloids and diverse exogenous stimuli including chemical agonists as capsaicin, olvanil and resiniferatoxin, identified as TRPV1 agonists. The TRPV1 contains a heat-sensitive subunit responsible for the burning sensation caused by capsaicin¹². Bonding of capsaicin to TRPV1 increases intracellular calcium, triggering release of neuropeptides such as substance P and the calcium gene-related peptide (CGRP). Contact between capsaicin and sensory neurons produce a localized heat sensation. Topically, it acts primarily on sensory-C fibers to cause depletion of substance P from the nerve terminals¹³. This, in turn causes desensitization of the sensory afferents¹⁴. This mechanism has served as a base for studies of the structure-activity relationship, which are aimed at development of new synthetic ligands for the TRPV1. Capsaicin's effects in the nervous system are not exclusively analgesic. Capsaicin also promotes the release of somatostatin, CGRP and endothelin¹⁵.

Immunity Booster

Green Chilli contains high amounts of beta-carotene, vitamin-A and vitamin-C, which help in building immune system of the body. Its active ingredient capsaicin also boosts the defense mechanisms of the body¹⁶.

Cardiovascular Benefits

Green Chili (*Capsicum frutescens*) reduces blood cholesterol, triglyceride levels, and platelet aggregation¹⁶. Thus, it lowers the risk of heart attack, stroke and pulmonary embolism. Green Chilli prevents the deposition of fats along blood vessel walls caused by free radicals, which is the first step in the development of atherosclerosis¹⁷. It lowers blood pressure and heart rate¹⁸. Hence, eating Green Chilli may be considered as a heart tonic.

Anti-inflammatory agent

Green Chilli's active ingredient, capsaicin is a potent inhibitor of substance P¹⁹. Substance P is a neuropeptide associated with inflammatory processes. It reduces the

inflammation by stimulating the blood flow to that area. Capsaicin reduced paw inflammation in animals and delayed the onset of arthritis²⁰. Green Chilli also protects lung tissue owing to its anti-inflammatory action.

Gastro protective Agent

Green Chilli provides protection against developing stomach ulcers by i) killing ingested bacteria ii) increasing the secretion of mucus and protective buffer solution²⁰ iii) Vasodilation mediated by nitric oxide and CGRP released by TRPV1 bearing cells¹⁵. Capsaicin possesses antibacterial property particularly against the bacteria *H. pylori* (which is one of the causative agent of stomach ulcer)⁵. Experimental evidences have shown that capsaicin-sensitive (CS) sensory nerves are involved in a local defense mechanism against gastric ulcer. CS sensory nerve stimulation by Chilli (at low concentration) has protected the rat gastric mucosa against different ulcerogenic agents²¹. Ulcers induced by aspirin can be prevented by *Capsicum frutescens*²².

Anti-rhinitic agent

Eating Green Chilli enhances nasal secretions and thus provides relief from congested nose. It is an ingredient of nasal sprays effective in relieving allergies and sinus problems like allergic rhinitis²³. As it possesses anti-inflammatory activity; it opens sinus passage by releasing allergens from the nose.

Anti-obesity agent

Green Chilli is a thermogenic agent. It increases the process of heat production. Oxygen consumption is also enhanced after eating green chilli. Obesity causes metabolic deregulation, hyperglycemia, hyperlipidemia, insulin resistant diabetes, and fatty liver disease²⁴. In obese people, diet containing green chilli significantly lowers the amount of insulin required to reduce blood sugar levels. Furthermore, it reduces LDL cholesterol levels and thus, helps in reducing weight.

Enhancement of insulin sensitivity

If a person's diet contains chilli, the amount of insulin required to lower the blood glucose is diminished. When consumed on regular basis, it may even drop the insulin level to the lowest. Green Chilli contains antioxidants like vitamin-C³ and carotenoids¹, which are thought to be useful in improving insulin regulation. Vitamin-C decreases the chronic inflammation in the body by combating free radicals, which are precursor of diabetes²⁵.

Anti-cancer agent

American Institute for Cancer Research noted that Green Chilli is a promising anti-cancer agent. Green Chilli was found to provoke apoptosis or programmed cell death in the cells causing human prostate cancer. Capsaicin had a profound anti-proliferative effect on human prostate cancer cells in culture. Another research showed that orally administered capsaicin reduced pancreatic tumors in mice²⁶. The underlying mechanism of action for the anti-cancer effect of chilli appears to be related to i) Triggered suicide of primary types of prostate cancer cell lines ii) Retarded expression of prostate-specific antigen (PSA) iii) Inhibition of PSA transcription resulting in rapid fall of PSA levels²⁷ iv) Disruption of mitochondria of the cells.

Anti-epileptic agent

Animal studies provide evidence for the antiepileptic potential of Green Chilli²⁸.

Anti-psoriatic agent

Green Chilli helps to reduce pain, inflammation, redness and scaling associated with psoriasis²⁹.

USES OF GREEN CHILLI

Culinary Uses:

Green chilli makes an integral component of Indian, Thai and Mexican cuisine. It is a favorite item used in cooking for almost all savory dishes like curries, daals, breads and appetizers. Salads, pickles, sauces, chutneys and spicy snacks are almost incomplete without this green small sized vegetable. Its addition as a garnishing or seasoning agent helps to make the dishes delicious.

Traditional uses:

- It prevents recurrence of fever (De seed a Green Chilli. Wear the hollow chilli around the right thumb. Tie it with a piece of clean cloth. Do this for 2 h before the expected time of the fever).
- It aids in digestion and improves eye-sight.
- The whole plant cooked in milk has been applied to reduce swellings and hardened tumors.
- A gargle, tincture or paste has been used for tonsillitis, sore throat and hoarse voice.

Medicinal uses:

Green chili removes wrinkles and scars. It burns a lot of calories and helps in digestion as it stimulates the taste buds, which cause an increase in the flow of salivary amylase. It possesses strong antioxidant properties. It is used for treating malarial and other fevers, gout, constipation and hemorrhoids. It has been used in neuralgic and rheumatic conditions as a stimulant. It is also believed to be good for lungs. Capsaicin is the active ingredient present in Green Chilli. It helps in dissolving blood clot and is used in the preparation of ointments and tinctures for their astringent, anti-pruritic³⁰, counter-irritant and analgesic properties. It is used in the treatment of arthritic pain, post herpetic neuropathic pain, sore muscles etc. Scientific studies suggest that capsaicin has anti-bacterial, anti-carcinogenic, analgesic and anti-diabetic properties. It has been found to reduce LDL cholesterol levels in obese persons. Its juice possesses antibacterial and antifungal activities. It is used in the management of urinary incontinence.

Miscellaneous uses:

As a repellent, it is a biochemical pesticide, which is used on vegetation such as trees and crops, on buildings and garbage containers for repelling rodents, cats, dogs etc. It is also used as an insecticide to repel spiders, mites and other invertebrates. It is also used as marine anti-fouling agent. It is commonly used as a non-lethal self-defense spray.

CONTRAINDICATIONS AND PRECAUTIONS

Chilli is contraindicated in patients, who are hypersensitive to capsicum or its products. It is contraindicated in pregnant ladies, as it stimulates the uterus. One should be careful, while handling chillies, since it can irritate or may even burn eyes. If consumed in large amounts, it could prove toxic, and may burn the mouth. But at lower doses, it seems to possess anti-cancer properties. Casein (a milk product) can help to suppress the Green Chilli fire.

CONCLUSION

Green chilli makes an integral component of Indian, Thai and Mexican cuisine. Salads, pickles, sauces, chutneys, curries and spicy snacks are almost incomplete without this green small sized vegetable. Green Chillies cleanse the skin and fair the complexion by stimulating perspiration. Green Chilli or *Capsicum frutescens* is a natural, spicy and hot food item belonging to potato family. Its active ingredient Capsaicin, responsible for its intense hot taste is mainly located in seeds or in the white pith, where seeds are

attached. A small Chilli fruit provides lots of dietary fibers, vitamins- A, C, B₂, B₆, E, along with several minerals and macronutrients. It possess numerous medicinal properties such as anti-cancer, anti-inflammatory, anti-oxidant, anti-hemorrhoidal, anti-obesity, gastro-protective, anti-pyretic and analgesic. It provides relief against various ailments like rhinitis, sinusitis, migraine, diabetes and arthritis. Thus, inclusion of Green Chilli preferentially in our daily diet offers plenty of health benefits.

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Do You Know???

- ❖ Eating Chilli on regular basis prevents development of cancer cells in the body.
- ❖ Chillies cleanse the skin and fair the complexion by stimulating perspiration.
- ❖ The hotness of any fruit is indicated on the Scoville scale.
- ❖ Scoville scale for Green Chilli ranges from 15,000 to 30, 0000.
- ❖ Human tongue can detect as low as 1ppm concentration of capsaicin.
- ❖ Green Chilli enhances the sensitivity of insulin.
- ❖ It is a powerful anti-pyretic agent, when applied over thumb.
- ❖ It can be used as a non-lethal self-defense spray.