



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2019; 7(5): 1538-1542

© 2019 IJCS

Received: 19-07-2019

Accepted: 23-08-2019

**Poobalan V**

Ph.D Scholar, Department of  
Vegetable Science, Tamil Nadu  
Agricultural University,  
Coimbatore, Tamil Nadu, India

**S Praneetha**

Professor (Hort.), Department of  
Vegetable Science, Tamil Nadu  
Agricultural University,  
Coimbatore, Tamil Nadu, India

**T Arumugam**

Dean (Hort.), Horticultural  
College and Research Institute,  
Periyakulam, Tamil Nadu, India

**N Kumaravadivel**

Professor and Head, Dept. of  
Plant Molecular Biology and Bio  
informatics, Tamil Nadu  
Agricultural University,  
Coimbatore, Tamil Nadu, India

**P Jeyakumar**

Professor and Head, Dept. of  
Crop Physiology, Tamil Nadu  
Agricultural University,  
Coimbatore, Tamil Nadu, India

**Correspondence****Poobalan V**

Ph.D Scholar, Department of  
Vegetable Science, Tamil Nadu  
Agricultural University,  
Coimbatore, Tamil Nadu, India

# International Journal of Chemical Studies

## Medicinal properties of vegetable crops

**Poobalan V, S Praneetha, T Arumugam, N Kumaravadivel and P Jeyakumar**

**Abstract**

Vegetables play a vital role in human nutrition and health by providing nutrients, vitamins, antioxidants, phytosterols, and dietary fiber. In the developing world, vegetable farming is a considerable part of the agricultural economy of different nations. Due to the potential health benefits provided by bioactive medicinal molecules such as lycopene, resveratrol, tannins, indoles, glucosinolates, polyphenols, phytoestrogens, carotenoids and anthocyanins etc; vegetables are receiving increased attention now a days. These bioactive medicinally important natural compounds present in vegetables offers various health benefits like prevention of cardiovascular disease, cancer and other diseases. Chlorogenic acid and nasunin present in brinjal have anti carcinogenic, anti-obesity, and anti-diabetic properties. Lycopene present in tomato, watermelon and carrot helps to protect against cancer and fight against infection. Allicin, allyl propyl disulfide and di-allyl disulfide present in onion and garlic etc., help to protect against certain cancers and heart disease; and also acts as immune-booster. Crucifers are the important source of sulforaphane which have anti-cancer property. Flavonoids (isoflavones) rich in beans lower the cholesterol and protect against cancer. Cucurbitacin present in cucurbits have anti-inflammatory and cardiovascular effects. Hence this article discusses about different bioactive compounds present in the vegetable crops and their medicinal properties.

**Keywords:** Antioxidants, vegetables, phytochemicals, laxative, healing

**Introduction**

Vegetables are considered to be protective foods since they contain low calories and higher vitamins and minerals. The presence of bioactive compounds like phytochemicals offers the vegetables medicinal values. The phytochemicals present in vegetables include carotenoids, phenolic compounds (Flavonoids, phytoestrogens, phenolic acids), phytosterols and phytostanols, tocotrienols, organo-sulfur compounds (Allium compounds and glucosinolates) and non-digestible carbohydrates (Dietary fiber and prebiotics). These phytochemicals function as antioxidants, antibacterial compounds, enzyme stimulators, etc. They also enhance health, modulate immunity and thereby prevent and cure gastrointestinal disorders, cardiovascular diseases, cancer, diabetes and other chronic diseases. Cruciferous vegetables, *Allium sp.*, tomato, cucurbits, carrot, bhendi, underexploited vegetables like lettuce, sweet potato, yams, moringa, winged bean, basella, cluster bean, etc. are good sources of bioactive compounds. In the recent past there has been a tremendous increase in the use of plant-based health products in developing as well as developed countries resulting in an exponential growth of herbal (vegetable) products globally. Hence, during upcoming time by analyzing the plants for available bioactive contents they may be introduced as future herbal medicine. Hence this article makes a review and discusses about the medicinal properties of vegetable crops.

Vegetables, like fruits, are low in calories and fats but contain good amounts of vitamins and minerals. All the Green-Yellow-Orange vegetables are rich sources of calcium, magnesium, potassium, iron, beta-carotene, vitamin B-complex, vitamin-C, vitamin-A, and vitamin K.

As in fruits, vegetables too are home for many antioxidants. These health benefiting phytochemical compounds help protect the human body from oxidant stress, diseases, and cancers and help the body develop the capacity to fight against these by boosting immunity.

Additionally, vegetables are packed with soluble as well as insoluble dietary fiber known as non-starch polysaccharides (NSP) such as cellulose, mucilage, hemi-cellulose, gums, pectin etc. These substances absorb excess water in the colon, retain a good amount of moisture in the fecal matter, and help its smooth passage out of the body.

Thus, sufficient fiber offers protection from conditions like chronic constipation, hemorrhoids, colon cancer, irritable bowel syndrome, and rectal fissures.

### Cucurbitaceae

This family comprises of about 13 genera and 800 species, which have purgative, anthelmintic anti-inflammatory and cardio-protective properties. The medicinal properties of cucurbits are mainly due to the presence of secondary metabolite cucurbitacin. Cucurbitacins are group of tetracyclic tri-terpenoids responsible for bitterness of cucurbits (Dhimman *et al.*, 2012) [12]. The anti-inflammatory activity of cucurbitacin is mainly due to their ability to inhibit cyclooxygenase enzyme (Peters *et al.*, 1997) [37].

### Bitter gourd

Botanically *Momordica charantia* is a most important medicinal crop of cucurbitaceae family. It is rich in phytochemicals that have hypoglycemic activity (Reduce the blood sugar level). Charatin is one such phytochemical which is a mixture of sitosteryl glucoside and stigma steryl glucoside which could be used to treat diabetes. Vicine, a glycoalkaloid present in the seeds of the bitter gourd and protein, polypeptide-p are also found to have hypoglycemic activity.

### Muskmelon

The fruit is used as a tonic, laxative, diuretic and diaphoretic. The fruits are used in the treatment of chronic eczema (Dhimman *et al.*, 2012) [12]. The fruits is also a powerful anti-oxidant.

### Bottle gourd

The fruits are used in the treatment of jaundice, diabetes, ulcer, piles and skin diseases. Fruit juice is a excellent remedy for heart problems, urinary problems and diabetes. Dietary fiber present in fruits helps in constipation, flatulence and piles. Seeds contain lagenin, a novel ribosome inactivating protein with ribo nucleolytic activity (Prajapathi *et al.*, 2010) [39].

### Pumpkin

The fruit is a cooling agent, increases appetite, cures leprosy and purifies the blood. Fruits contain cucurbitane and hexane cucurbitane glycosides and other triterpenoids (Ge *et al.*, 2006) [16]. Seeds are used to treat benign prostatic hyperplasia (Abdel-Rahman, 2006) [7]. Anti-ulcer type cucurbitane has been isolated from the seeds of pumpkin.

### Cucumber

Cucumber fruits aid in removing constipation and indigestion. The fruit also acts as a coolant and demulcent. Glycosides having anti-ulcer properties are present in leaves and seeds of cucumber (Dhimman *et al.*, 2012) [12].

### Ash gourd

The fruit is recommended for the management of peptic ulcer, hemorrhages, asthma, cough, diabetes, epilepsy and other nervous disorders. Seeds contain, Hispin which is a novel ribosome inactivating protein with antifungal activity (Ng and Prakash, 2002) [33].

### Chayote

Chow-chow or Chayote is used in the treatment of inflation and circulatory system disorders. The fruits have anti

hypersensitive and anti-oxidant effects (Dhimman *et al.*, 2012) [12].

### Solanaceae

#### Tomato

Tomato is the richest source of Lycopene and Vitamin- C. Lycopene is a vital anti-oxidant that helps to fight against cancerous cell formation. High potassium helps to maintain nerve health and high iron helps to maintain blood health (Sesso *et al.*, 2004) [41]. Tomatoes are rich in vitamin K which plays a major role in blood clotting. It also improves eye health and prevents hypertension and urinary tract infections. Anthocyanin present in tomato protects against cancer. For skin protection, tomato intake (40 g tomato pastes corresponding to a lycopene dose of approximately 16 mg) for more than 8 weeks reduced ultraviolet light induced erythema (Stahl *et al.*, 2001) [48]. Lycopene also reduces stomach and rectal cancers (Rao *et al.*, 2007) [5].

#### Brinjal

Phytochemicals contained in eggplant include phenolic compounds, such caffeic and chlorogenic acid, and flavonoids, such as nasunin. Nasunin or delphinidin- 3-(Coumaroyl rutinoside)-5-glucoside is the major phytochemical in eggplant. Nasunin is part of the anthocyanin purple pigment found in the peel of eggplant. Anthocyanins enriched vegetables are brinjal prevents from cardiovascular dysfunction and protective effect on pancreatic cells (Kumar *et al.*, 2017) [25]. Chlorogenic acid also acts as potential anti-oxidant. Benefits attributed to chlorogenic acid also include antimutagenic (anti-cancer), anti-microbial, anti-low-density lipoproteins (bad cholesterol) and antiviral activities. Eggplant fruits also contain several other antioxidants including the carotenoids lycopene, lutein, and  $\alpha$ -carotene, as well as the flavonoids myricetin and kaempferol (Miean *et al.*, 2001) [22]. Eggplant is effective in the treatment of high blood cholesterol. (Guimaraes *et al.*, 2000) [35].

#### Chilli

Capsaicin present in chilli has anti-bacterial, anti-carcinogenic, analgesic and anti-diabetic properties. Capsaicin is used as an analgesic in topical ointments, and skin ailments to relieve pain. It also tends to reduce LDL cholesterol levels in obese individuals. They also rich in anti-oxidants like beta carotene, lutein, zeaxanthin, cryptoxanthin and vitamin C. Red peppers are a good source of lycopene, which is earning a reputation for helping to prevent prostate cancer as well as cancer of the bladder, cervix, and pancreas (Howard *et al.*, 2000) [28].

#### Potato

Starch present in potato offers protection against colon cancer, improves glucose tolerance and insulin sensitivity, lowers plasma cholesterol and triglyceride concentrations. Unique tuber storage protein called patatin, has activity against free radicals. Institute for Food research UK has identified compounds called as kukoamines are known for its blood pressure lowering compounds. Chlorogenic acid constitutes up to 90% of total phenols of the potato tuber. It contains Carotene- $\beta$ , Cryto-xanthin- $\beta$ , Lutein which have antiscorbutic, aperient, diuretic, galactagogue, stimulant, emollient, antidote, antispasmodic properties (Chakraborty *et al.*, 2010) [9]. Cao *et al.* estimated the total antioxidant capacity of potato to be in the medium range among 22 commonly consumed vegetables. Potato also contributes a

small amount of selenium (0.01 mg/kg) and folate (0.35 mg/kg) to the human diet.

## Alliaceae

### Onion

Sulfides in onion extracts provide protection against tumor growth especially stomach and colon cancer. Onions have anti-inflammatory properties due to their vitamin C and quercetin. The high amount of fructo-oligosaccharide in onions stimulates the growth of healthy bacteria and suppresses the potentially harmful bacteria in the colon such as *Bacillus subtilis*, *Salmonella*, and *E. coli* (Chiej, 2004)<sup>[11]</sup>. The regular consumption of onion lowers blood pressure and the serum levels of cholesterol and triglyceride, while increasing HDL levels. Onions tend to decrease the risk of heart disease due to the presence of vitamin B<sub>6</sub>, which lowers homocysteine levels, an important risk factor for heart attacks and strokes. Gamma-L-glutamyl-trans-S-1-propenyl-L-cysteinesulfoxide (GPCS) in onion inhibits the osteoclasts (The cells which break down bone) activity and fights osteoporosis. (Sampath Kumar *et al.*, 2010)<sup>[40]</sup>.

### Garlic

Garlic is one of the most important herbs for the digestive systems. It stimulates peristalsis or movement of the intestines and these creation of the digestive juices; Allicin present in garlic have anti-bacterial and anti-fungal activity (Lawson LD, 1996)<sup>[29]</sup>. Quercetin, diallylsulphide and allin present in garlic has the ability to block cancer causing agents such as nitrosamine and aflatoxins which have been specifically linked to stomach, lung and liver cancer.

## Cruciferae

A striking and characteristic chemical property of cruciferous plants is their high concentration of glucosinolates. Isothiocyanates and Sulforaphane are the bio-transformation products of glucosinolates blocking enzymes which are responsible for tumorous growth in liver, lung, and gastrointestinal tracts. Sulforaphane is rich in broccoli, causes cell cycle arrest and apoptosis of cancer cells and also has anti-inflammatory, antimicrobial activity. Indole-3-Carbinol, most important indole in broccoli and cabbage is also found to be anti-cancerous.

## Legumes

Fibre from the seed coat and the cell walls of the cotyledon of peas is beneficial for gastrointestinal function and health (Dahl *et al.*, 2012). Consumption of cluster bean leads to low serum cholesterol levels, antidiabetic properties, and prevention of cardiovascular and cancerous diseases. Velvet bean possesses a phytochemical known as L-Dopa, which is a non-protein amino acid present in a higher concentration within its seed; it is used to treat Parkinson's disease. Winged bean rich in protein (>30%) is used as antimicrobial agent in traditional medicines. Apart from these legumes found to be rich in phytoestrogens and saponins. Phytoestrogens act as antioxidants that could prevent cancer by scavenging free radicals and lowering blood cholesterol. Saponins are found to be anti-carcinogenic.

## Under-exploited vegetables

### *Allium odorosum*

This herb is traditionally used in various folklore medicine as diuretic and as wormicide to infants suffering from tape, thread and round worms.

### *Allium hookerii*

It is also served by steaming or boiling in water for those who are suffering from urinary troubles. In fact, the herb acts to regulate the normal flow of urine and is a very common practice used by the local physicians. (Vijayan *et al.*, 2007)<sup>[45]</sup>.

### False coriander (*Eryngium foetidum* Linn.)

The root is commonly served in stomach trouble. In folk treatment, decoction of the herb @ a teaspoonful twice daily for a week after meal serves in case of high blood pressure (Shrivastava, 1996)<sup>[42]</sup>.

### Amaranth (*Amaranthus viridis* Linn.)

It is considered diuretic with cooling effect. The root is efficacious in menorrhagia. In case of stone formation along the urinary tract, a preparation from the whole plant is effectively used.

### Swamp cabbage (*Ipomoea aquatica* Forsk.)

The leaves contain plenty of minerals and vitamins, especially carotene. The herb is considered wholesome for woman suffering from nervous and general debility.

### Red spinach (*Plumbago lanic* Linn.)

Fresh red spinach is more nutritive than cooked one. Drinking juice of raw green leaves helps man in curing teeth prone to caries (decay of teeth) or in bleeding gums. It is also curative in respiratory tract ailments.

### Water cress (*Enhydra fluctuans* L.)

It is laxative, anti-bilious and demulcent. The herb is also used in the treatment of nervous affection and to induce sleep. Decoction of leaves and shoots is given in urinary trouble resulted due to calculus development.

### Mango ginger (*Curcuma amada* Roxb.)

It also acts as stomachic and carminative, cooling and useful in prurigo. Amvasta *et al.* (1986) reported that the rhizomes are useful on confusion and sprains.

## Conclusion

Regular consumption of a vegetable rich diet has positive effects on health since phyto nutraceuticals of vegetables can protect the human body from several types of chronic diseases. Various components of the whole food are likely to contribute to the overall health benefit. Various phyto nutraceuticals with antioxidant properties may work directly by quenching free radicals or indirectly by participating in cell signaling pathways. Nutrients such as potassium contribute to blood pressure regulation. The dietary fiber content and type of different vegetables may also contribute to the overall health benefit, such as improving bowel transit, lowering cholesterol, helping manage blood glucose concentrations, and by transporting a significant amount of minerals and phytochemicals linked to the fibre matrix through the human gut. Thus increasing vegetables in the diet may reduce the intake of saturated fats, trans fats, and foods with higher caloric density, all of which may be related to a healthier overall diet. Because each vegetable contains a unique combination of phyto nutraceuticals (vitamins, minerals, dietary fiber and phytochemicals), a great diversity of vegetables should be eaten to ensure that individual's diet includes a combination of phyto nutraceuticals and to get all

the health benefits. The availability of a large diversity of vegetables year round, allied to increase in mean per capita incomes in recent years and knowledge of vegetable health benefits, have enable consumers to include a variety of health promoting phyto nutraceuticals in human diet.

## References

- Ben-Amos A, R Fishler. Analysis of Carotenoids with Emphasis on 9-*cis*  $\beta$ -carotene in Vegetables and Fruits Commonly Consumed in Israel. *Food Chemistry*. 1998; 62(4):515-520.
- Giamoustraris A, R Mithen. Genetics of Aliphatic Glucosinolates. 4. Side-Chain Modification in Brassica oleracea. *Theoretical and Applied Genetics*. 1996; 93(5-6):1006-1010
- Kurilich A, GJ Tsau, A Brown, L Howard, B Klein, E Jeffery *et al.* Carotene, Tocopherol and Ascorbate Contents in Sub- Species of Brassica oleracea. *Journal of Agriculture and Food Chemistry*. 1999; (47)1576-1581.
- Ong AS, ES Tee. Natural Sources of Carotenoids from Plants and Oils, *Methods in Enzymology*. 1992; 213:142-167.
- Rao AV, LG Rao. Carotenoids and Human Health, *Pharmacological Research*. 2007; 55(3):207-216.
- Rao AV, Z Waseem, S Agarwal. Lycopene Contents of Tomatoes and Tomato Products and Their Contribution to Dietary Lycopene, *Food Research International*. 1998; 31(10):737-741.
- Abdel-Rahman MK. Effect of pumpkin seed (*Cucurbita pepo* L.) diets on benign prostatic hyperplasia (BPH): Chemical and morphometric evaluation in rats. *World J Chem*. 2005; 1:33-40.
- Frei B, S Lawson. Vitamin C and Cancer Revisited, *Proceedings of the National Academy of Sciences (USA)*. 2008; 105(32):11037-1103-222, 2005.
- Chakraborty S, Chakraborty N, Agrawal A, Ghosh S, Narula K, *et al.* Next-generation protein-rich potato expressing the seed protein gene AmA1 is a result of proteome rebalancing in transgenic tuber. *Proceeding of National Academy of Sciences USA*. 2010; 107:17533-17538.
- Chauhan DVS. *Vegetable Production in India*. Ram Prasad and Sons, Agra, India. 2010; 1972:5-7.
- Chiej R. *Encyclopaedia of Medicinal Plants*. MacDonald, 2004.
- Dhimman K, A Gupta, DK Sharma, NS Gill, A Goyal. A review on the medicinally important plants of Cucurbitaceae. *Asian Journal of Clinical Nutrition*. 2012; 4(1):16-26
- Duke JA. *Handbook of Phytochemical and Constituents of Grass Herbs and other Economic Plants*. CRC Press, Boca Raton. 1999; 98-119, 2012.
- Cieslik E. The Effect of Naturally Occurring Vitamin C in Potato Tubers on the Levels of Nitrates and Nitriles. *Food Chemistry*. 1994; 49(3):233-235, 2012.
- Giovannucci E. Tomatoes, Tomato-Based Products, Lycopene, and Cancer: Review of the Epidemiological Literature, *Journal of the National Cancer Institute*. 1999; 91(4):317-331. HD.
- Wang Ge S, DC LJ Wu, XM Deng. Triterpenes from the fruits of *Cucurbita pepo* CV Dayangua. *J. Shengyang Pharm*. 2006; 23:55-59.
- Gill NS, M Bali. Evaluation of anti-oxidant, antiulcer activity of glycosides from *Cucumis sativus* seeds. *Res. J. Med Plant*. 2012; 6:309-317.
- Gerster H. The Potential Role of Lycopene for Human Health. *Journal of the American College of Nutrition*. 1997; 16(2):109-126, 2012.
- Djujic I, B Djujic, L Trajkovic. Dietary Intake of Selenium in Serbia: Results for 1991 Conference Selenium. *Nauc. Skup. Srp. Akad. Nauk. Umet*. 1995; 6:81-87.
- Lachman J, JK Hamouz, M Orsak, V Pivec. Po-tato Tubers as a Significant Source of Antioxidants in Human Nutrition. *Rostlinná Výroba*. 2000; 6(5):231-236.
- Okeyo J, Kushad M. Composition of Four Potato Cultivars in Relation to Cold Storage and Reconditioning. *Hort Technology*. 1995; 5(3):250-253.
- Miean KH, S Mohamed. Flavonoid (Myricetin, Quercetin, Kaempferol, Luteolin and Apigenin) Content of Edible Tropical Plants. *Journal of Agriculture and Food Chemistry*. 2001; 49(6):106-112.
- Kayamori F, K Igarashi. Effect of Dietary Nasunin on the Serum Cholesterol Level in Rats. *Bioscience, Biotechnology, and Biochemistry*. 1994; 58:570-571.
- Khana G. *Herbal Remedies, A Hand Book of Folk Medicine*. Tarang paperbacks, New Delhi, 1982.
- Kumar P, Shaunak I, Thakur AK, Srivastava DK. Health Promising Medicinal Molecules in Vegetable Crops. *J Genet Geno*. 2017; 1:102.
- Packer L. Vitamin E Is Nature's Master Antioxidant. *Science & Medicine*. 1994; 1(1):54-63.
- Howard LR, RT Smith, AB Wagner, B Villalon and EE Burns. "Provitamin A and Ascorbic Acid Content of Fresh 22. Pepper Cultivars (*Capsicum annum*) and Processed Jalapenos. *Journal of Food Science*. 1994; 59(2):362-365.
- Howard SL, RT Talcott, CH Brenes, B Villalon. "Changes in Phytochemical and Antioxidant Activity of Selected Pepper Cultivars (*Capsicum* species) as Influenced by Maturity. *Journal of Agriculture and Food Chemistry*. 2000; 48(5):1713-1720.
- Lawson LD, Wang ZYJ. Changes in the organo sulphur compounds released from garlic during aging in water, dilute ethanol or dilute acetic acid. *J Toxicol*. 1996; 14:214. lectin, Glycoconj. J12. 1995; 690-698, 1996.
- Hagg M, R Hakkinen, J Kumpulainen, R Ahvenainen, E Hurme. Effects of Preparation Procedures, Pack-aging and Storage on Nutrient Retention of Peeled Potatoes, *Journal of the Science of Food and Agriculture*. 1998; 77(4):519-526.
- Morie DS. *A Book on Tribal Medicine*. Society for promotion of waste land development, New Delhi, 1985.
- Matsuzoe N, M Yamaguchi, S Kawanobu, Y Watanabe, H Higashi, Y Sakata *et al.* Effect of Dark Treatment of the Eggplant on Fruit Skin Color and Its Anthocyanin Components. *Journal of the Japanese Society for Horticultural Science*. 1999; 68(1):138-145.
- NG TB, A Prakash. Hispin, a novel ribosome inactivating protein with antifungal activity from hairy melon seeds. *Protein Expr. Purif*. 2002; 26:211-217.
- Jorge PA, LC Neyra, RM Osaki. Effect of Eggplant on Plasma Lipid Levels, lipidic Peroxidation and Reversion of Endothelial Dysfunction in Experimental Hypercholesterolemia. *Arquivos. Brasileiros de Cardiologia*. 1998; 70(2):87-91, 2002.
- Guimaraes PR, AM Galvao, CM Batista, GS Azevedo, RD Oliveira, R Lamounier *et al.* Eggplant (*Solanum melongena*) Infusion Has a Modest and Transitory Effect on Hypercholesterolemic Subjects. *Brazilian Journal of*



- Medical and Biological Research. 2000; 33(9):1027-1036.
36. Bosland PW. Capsicums: Innovative Uses of an Ancient Crop. In: J. Janick, Ed., Progress in New Crops, ASHS Press, Arlington. 1996; 479-487.
  37. Peters R, MR Farias, RM Ribeiro-Do-Valle. Anti-inflammatory and analgesic effects of cucurbitacins from *Will brandiaebrcteata*. *Planta Medicine*. 1997; 63:525-528.
  38. Rahman ASH. Bottle gourd (*Lagenaria siceraria*) a vegetable for good health. *National Product Radiance*. 2003; 2:249-250.
  39. Rakesh, P Prajapati, Manisha Kalariya, Sachin K Parmar, Navin R Sheth. Phytochemical and pharmacological review of *Lagenaria siceraria*, *Journal of Ayurveda & Integrative Medicine*; 2010; 1(4):267-272
  40. Sampath Kumar, KP, Debjit Bhowmik, Chiranjib, Biswajitand, Pankaj Tiwari. *Allium cepa*: A traditional medicinal herb and its health benefits, *J Chem. Pharm. Res*. 2010; 2(1):283-291
  41. Sesso J, E Buring, EP Norkus, JM Gaziano. Plasma Lycopene, Other Carotenoids, and Retinol and the Risk of Cardiovascular Disease in Women. *The American Journal of Clinical Nutrition*. 2004; 79(1):47-53.
  42. Shrivastava J, Lambart J, Vietmeyer N *et al*. Medicinal Plants: An expanding role in development. World Bank Technical paper. 1996; 320.
  43. Singh AJ. Vegetable in Manipur. Ruby Press & Co. 2<sup>nd</sup>Edt. 2013; 104-105.
  44. Tijani Y, Uguru MO, Salawu OA *et al*. Anti-pyretic, anti-inflammatory and anti-diarrhoeal properties of *Faidherbia albida* in rats. *African J Biotech*. 2008; 6:696-700.
  45. Vijayan A, Liju VB, Reena, John JV, Parthipan B, Renuka C *et al*. Traditional remedies of Kani tribes of Kottorreserve forest Agasthavanam, Thiruvanthapuram, Kerala Indian J Traditional Knowledge. 2007; 6(4):589-594.
  46. Stahl W, H Sies. Carotenoids and Protection against Solar UV Radiation. *Skin Pharmacology and Applied Skin Physiology*. 2002; 15(5):291-296.
  47. Stahl W, U Heinrich, O Aust, H Tronnier, H Sies. Lycopene-Rich Products and Dietary Photo protection. *Photochemical Photobiology Science*. 2006; 5(2):238-242.
  48. Stahl W, U Heinrich, S Wiseman, O Eichler, H Sies, H Tronnier. Dietary Tomato Paste Protects against Ultraviolet Light-Induced Erythema in Humans. *The Journal of Nutrition*. 2001; 131(5):1449-1451.
  49. Noda Y, T Kaneyuki, K Igarashi, A Moriand, L Pacer. Antioxidant activity of nasunin, an anthocyanin in eggplant. *Research Communications in Molecular Pathology and Pharmacology*. 1998; 102(2):175-187.
  50. Noda Y, T Kneyuki, K Igarashi. Antioxidant Activity of Nasunin, an Anthocyanin in Eggplant Peels. *Toxicology*. 2000; 148(2-3):119-123.
  51. Yalcin H, Capar TD. Bioactive Compounds of Fruits and Vegetables. In: Yildiz F, Wiley R (eds.) Minimally Processed Refrigerated Fruits and Vegetables. Food Engineering Series MA, 2017.