

## Antioxidants in Vegetable Crops

**Arjun Singh**

Department of Horticulture, Rani Lakshmi Bai Central Agricultural University, Jhansi

**ARTICLE ID: 049**

### Introduction

The antioxidants contained in greens play an important role within the upkeep of health and prevention of disorder. A quantity of nutrients such as A, C, E, as properly as carotene are notable antioxidants, which additionally contribute to top health thru other mechanisms, such as being co-factors for positive enzymes, involvement in oxidation reduction reactions. It has been expected that every serving boom in vegetable intake reduces the risk of cancer by using 15%, cardiovascular disorder through 30% and mortality via 20%, attributable to antioxidants such as ascorbic acid, nutrition E, carotenoids, lycopene's, polyphenols, and other photochemical. A weight loss program rich in sparkling veggies protects from the risk of maximum commonplace epithelial cancers, such as those of the digestive tract, and several non-digestive neoplasm's. Decided on antioxidants,  $\beta$ -carotene, vitamins C and E confirmed a tremendous inverse relation with the threat of oral, pharyngeal, esophageal and breast cancers. In opposition to colorectal most cancers, the maximum steady protective consequences had been supplied through carotene, riboflavin and diet C, but inverse family members had been found for calcium and vitamin D. Probably ant carcinogenic marketers observed in vegetables additionally encompass numerous micronutrients, such as selenium, nutritional fiber, glucosinolates and indoles, flavonoids, phenols, protease inhibitors and plant sterols. The anti-most cancers function of carotenoids may be related to their ability to quench singlet oxygen. Yellow and orange veggies and dark-inexperienced leafy vegetables include carotenoids and flavonoids. Of the 22 species of vegetables investigated through Muller, kale, red paprika, leaf of parsley, spinach, Lamb's lettuce, carrot and tomato have been very wealthy in carotenoids (over 10 mg/one hundred g fit for human consumption component). B-carotene is the maximum famous carotenoid, and is discovered in maximum orange greens. Sweet potatoes and carrots are especially excessive in  $\beta$ -carotene. Green leafy veggies such as spinach, kale, broccoli,

Brussels sprouts and cabbage are reasonably excessive in  $\beta$ -carotene. A- and  $\beta$ -carotene, and lycopene, are hydrocarbon carotenoids. Lycopene is determined in tomatoes, however is scarce in other commonplace veggies. The primary carotenoids in these greens are the oxygenated carotenoids (xanthophylls). Lutein is the primary oxygenated carotenoid in kale, spinach, parsley and mustard greens. Carotenoids are destroyed to some quantity by way of cooking greens, and among specific carotenoids, the oxygenated carotenoids are destroyed to a greater extent than  $\beta$ -carotene. Flavonoids are a massive organization of natural phenolic compounds contained at excessive concentrations in vegetables. Flavonoids like catechin, quercetin, dihydroquercetin and rutin own antioxidant houses. Many veggies supply distinctive sorts of flavonoids in varying portions. Quercetin, component of a subclass of flavonoids referred to as flavonols, paperwork the predominant antioxidant component in greens. Quercetin is provided by way of vegetables like broccoli, onions, parsley and inexperienced leafy veggies.

The antioxidants contained in vegetables play an important role in the maintenance of health and prevention of disease. A number of vitamins such as A, C, E, as well as carotene are excellent antioxidants, which also contribute to good health through other mechanisms, such as being co-factors for certain enzymes, involvement in oxidation-reduction reactions. It has been estimated that every serving increase in vegetable consumption reduces the risk of cancer by 15%, cardiovascular disease by 30% and mortality by 20%, attributable to antioxidants such as ascorbic acid, vitamin E, carotenoids, lycopenes, polyphenols, and other photochemical. A diet rich in fresh vegetables protects from the risk of most common epithelial cancers, including those of the digestive tract, and several non-digestive neoplasm's. Selected antioxidants,  $\beta$ -carotene, vitamins C and E showed a significant inverse relation with the risk of oral, pharyngeal, oesophageal and breast cancers. Against colorectal cancer, the most consistent protective effects were provided by carotene, riboflavin and vitamin C, but inverse relations were observed for calcium and vitamin D. Potentially anticarcinogenic agents found in vegetables also include numerous micronutrients, such as selenium, dietary fiber, glucosinolates and indoles, flavonoids, phenols, protease inhibitors and plant sterols. The anti-cancer role of carotenoids may be related to their ability to quench singlet

oxygen. Yellow and orange vegetables and dark-green leafy vegetables contain carotenoids and flavonoids. Of the 22 species of vegetables investigated by Muller, kale, red paprika, leaf of parsley, spinach, Lamb's lettuce, carrot and tomato were very rich in carotenoids (over 10 mg/100 g edible portion).  $\beta$ -carotene is the most well-known carotenoid, and is found in most orange vegetables. Sweet potatoes and carrots are especially high in  $\beta$ -carotene. Green leafy vegetables such as spinach, kale, broccoli, Brussels sprouts and cabbage are moderately high in  $\beta$ -carotene.  $\alpha$ - and  $\beta$ -carotene, and lycopene, are hydrocarbon carotenoids. Lycopene is found in tomatoes, but is scarce in other common vegetables. The predominant carotenoids in these vegetables are the oxygenated carotenoids (xanthophylls). Lutein is the major oxygenated carotenoid in kale, spinach, parsley and mustard greens. Carotenoids are destroyed to some extent by cooking vegetables, and among different carotenoids, the oxygenated carotenoids are destroyed to a greater extent than  $\beta$ -carotene. Flavonoids are a large group of natural phenolic compounds contained at high concentrations in vegetables. Flavonoids like catechin, quercetin, dihydroquercetin and rutin possess antioxidant properties. Many vegetables supply different types of flavonoids in varying quantities. Quercetin, part of a subclass of flavonoids called flavonols, forms the main antioxidant component in vegetables. Quercetin is supplied by vegetables like broccoli, onions, parsley and green leafy vegetables.

### **Tomatoes**

Tomatoes, one of the maximum produced and fed on greens international, are a rich deliver of lycopene,  $\beta$ -carotene, folate, potassium, diet C (ascorbic acid), chlorogenic acid, flavonoids, rutin, plastoquinones, phenolics, tocopherol (diet E) and xanthophylls. The not unusual values obtained for antioxidant additives in three sparkling cultivars are ascorbic acid, 276 mg/a hundred g dry count number wide variety; total phenolics, 613 mg gallic acid equivalents/a hundred g dry rely, and lycopene 38 mg/100 g dry depend.

Tomatoes, one of the maximum produced and ate up veggies international, are a rich supply of lycopene,  $\beta$ -carotene, folate, potassium, diet C (ascorbic acid), chlorogenic acid, flavonoids, rutin, plastoquinones, phenolics, tocopherol (diet E) and xanthophylls. The average values acquired for antioxidant components in three clean cultivars are



ascorbic acid, 276 mg/100 g dry matter; total phenolics, 613 mg gallic acid equivalents/100 g dry be counted, and lycopene 38 mg/100 g dry be counted .

Vitamin C is considered a good antioxidant because it supplies electrons to enzymes or other compounds that are oxidizing agents. Tomatoes are relatively low in beta-carotene, but high in lycopene, an active antioxidant with no vitamin A activity. Lycopene is an interesting antioxidant found in ripe tomatoes, which are fairly stable during storage and cooking and are widely consumed. This reduces the risk of heart disease and cancer in part. In addition, many epidemiological studies have shown that regular consumption of tomatoes can reduce the risk of cardiovascular disease and reduce the risk of breast, colon, lung, and prostate cancer. The non-commercial red tomato oleoresin contains high amounts of lycopene with high antioxidant capacity and ant mutagenic activity, which indicates its usefulness.

### **Chilli and Sweet Pepper**

Pepper is a source of essential nutrients in the human diet and is an excellent source of vitamins A, C and E, as well as neutral and acidic phenolic antioxidants necessary for plant defense reactions. Two phenolic fractions isolated from amniotic fluid, flavonoids (including phenolic acids) and capsaicinoids, exhibited antioxidant activity. The levels of these compounds can vary with genotype and maturity and are dependent on growth conditions and post-treatment loss. Typically, levels of carotenoids, ascorbic acid, flavonoids, phenolic acids, and other chemical constituents rise until the pepper is cooked while lutein levels decline. With the exception of yellow varieties, provitamin A levels increase with color development in most varieties, and brown peppers have the highest provitamin A activity compared to other colored peppers. Colored peppers are a good source of carotenoid-rich antioxidants found during cooking.

Cooking and harvesting times affect the production of antioxidants and oxidative processes in pepper. Each type of pepper contains different antioxidants depending on the harvest season. However, now seems to be the best time to harvest all varieties at the same time. The nutritional value of pepper is largely determined by the content of ascorbic acid. One study found that ascorbic acid levels gradually increase from green to red and decline in later stages (partially dried red fruits and fully dried red fruits). The variability in genotype ascorbic acid

indicates that this selected genotype may be beneficial to older adults in hybridization programs that produce fruits with good nutritional value.

### **Bulb and Root Crops**

The aerial parts (leaves and stems) of radish (*Raphanus sativus*) that are usually removed have strong antioxidant and free radical activity as measured by standard antioxidant assays. The identification of polyphenols by HPLC showed the presence of catechins, protocatechic acid, syringic acid, vanillic acid, ferulic acid, bran acid, o-coumaric acid, myricetin, and quercetin in leaves and stems. Radish leaves and stems contain 86.16 and 78.77 mg / g of polyphenols in dry extract, respectively. Consequently, parts that are not commonly used in vegetables are high in polyphenols. Hence, it should be viewed as a potential source of natural antioxidants and can be effectively used as a health component or as a functional food.

Carrots are rich in fiber, carotenoids, vitamins C and E, and phenols such as coumaric, chlorogenic and caffeic acids. The water-soluble anthocyanins in carrots also have antioxidant properties. Drinking carrot juice can help protect your cardiovascular system by increasing your overall antioxidant status and decreasing lipid peroxidation. The water-soluble antioxidant properties of carrot juice can be improved by heat treatment and retained by high pressure treatment.

### **Cruciferous Vegetables**

Cruciferous vegetables are rich in polyphenols, flavonoids and glucosinolates, and are also rich in hydrolyzed foods with antibacterial, antioxidant and anti-cancer properties. Brassica vegetables are found in Plumb et al. Although its antioxidant activity is quite low, hydrolysis products can help prevent cancer.

In general, cabbage is the worst source of vitamin C among cabbages. The red pigmentation of red cabbage is caused by anthocyanins, which are found in flavonoids. The total carotenoid content in cherry cabbage, broccoli, red and white cabbage was 6.1, 1.6, 0.43 and 0.26 mg / 100 g, respectively. Lutein and  $\beta$ -carotene are the dominant carotenoids in cruciferous vegetables. Brassica vegetables also contain cryptoxanthin, neoxanthin, and

violaxanthin, but only broccoli contains cryptoxanthin (0.024 mg / 100 g). The order of reducing the total amount of tocopherols and tocotrienols in cabbage vegetables is as follows ☺) d) > red cabbage (0.05 mg / 100 g) > white cabbage (0.04 mg / 100 g).

Investigation of changes in the antioxidant potential of cabbage grown when nutrients are added to the soil from agricultural and food sources have shown that the addition of additives to the soil increases antioxidant activity. Among different vegetable species, broccoli distinguishes itself by its high concentration of Braccoli is distinguished by the presence of numerous bioactive substances with health-selling properties. Amongst those bioactive compounds, glucosinolates, phenolics, vitamins C, B1, E, carotenoids and selenium deserve unique interest. An additional benefit of broccoli is its tendency to accumulate heavy metals. Broccoli florets had been characterized by means of in particular excessive glucoraphanin content (17.95  $\mu\text{mol/g}$  of dry weight), which comprised about 50% of total glucosinolates.

The high ascorbic acid and phenolic content of fresh broccoli helps neutralize free radicals. The development of broccoli heads is accompanied by the loss of chlorophyll and ascorbic acid. The accumulation of dissolved phenol was observed at the prefluorescence stage. Purple broccoli contains more antioxidants than green broccoli, but tends to be more sensitive to cooking. In these dietary guidelines, you need to be careful about how you cook it. Cooked broccoli is very different from raw broccoli in its antioxidant properties. The antioxidant content of broccoli persists or increases after microwave use than after cooking. When boiled in water, it has an antioxidant effect and prolongs cooking time.

### **Green Leafy Vegetables**

Green leafy vegetables are rich in antioxidant vitamins. Ascorbic acid, total carotene,  $\beta$ -carotene and total phenols of green leafy vegetables, namely *Amaranthus* sp., *Centella asiatica*, *Murraya koenigii* and *Trigonella foenum graecum*, are between 15.18-101.36, 34.78-64.51, 4.23-8, 84 and 150.0-387, 50 mg. / 100 g, has the highest antioxidant activity in *Murraya koenigii* and the lowest in *Centella asiatica*. Lettuce is a powerful antioxidant and another healthy ingredient. Of the many types of lettuce grown most commonly, medicinal phytochemicals are the most abundant. Red screen lettuce with loose red leaves usually has a higher total phenolic concentration and antioxidant capacity. Red Screen also contains a large

amount of the main phenolic compound, chlorogenic acid. Genotypes can influence the level and composition of antioxidants in plants, as well as growth and care conditions. Growing conditions significantly affect the content of many phenolic compounds in lettuce. Growing lettuce outdoors has a positive effect on your health compared to growing in tall tunnels. Spinach and kale are also rich in carotenoids and polyphenols. Spinach has high total polyphenol and flavonoid content. The high level of polyphenol acids and flavonoids in spinach leaves influences the high antioxidant activity. Spinach and kale also contain lutein, which is known for its antioxidant activity. The concentrations of lutein measured 0.43 to 0.88 mg/g for frozen spinach, and 0.83 mg/g for fresh spinach .

#### **Drumstick**

Moringa (*Moringa oleifera*) is used in traditional Indian medicine for various ailments. Ripe soft moringa leaves have powerful antioxidant properties against free radicals, preventing oxidative damage to vital biomolecules and providing significant protection against oxidative damage.

#### **Conclusion**

Vegetables are high in antioxidants, which have great potential as protected foods. Their importance as anticancer drugs in human nutrition is increasing. The consumption of vegetables and their products should be encouraged among the population in order to improve diet and health.