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Importance of antioxidant in our life

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Abstract

Antioxidants play important role in the prevention of free radical formation and helps in reducing various disorders such as cancer, aging, cardiovascular disease, cataracts, immune system decline, and brain dysfunction. There are several foods such as fruits, green leafy vegetables, tea, coffee, nuts and oilseeds which have been found to have good antioxidants potential. Antioxidants are abundant in natural dietary sources, and the consumption of antioxidants has a lot of potential health benefits. Antioxidants are essential and important for plants and animals' sustenance. They are substances that protect cells from the damage caused by unstable molecules known as free radicals. The types of antioxidants such as ascorbic acid, glutathione, melatonin, tocopherols and tocotrienols were reported. The classification and characteristics of antioxidant; its measurements and level in food and free radicals were also documented. Antioxidants are an inhibitor of the process of oxidation, even at relatively small concentration and thus have diverse physiological role in the body. Antioxidant constituents of the plant materials like fruits act as radical scavengers and helps in converting the radicals to less reactive species. A variety of free radical scavenging antioxidants is found in dietary sources such as fruits, vegetables and tea, etc. This review presents some information about the antioxidant/antiradicals and their role in our body and also their presence in a few fruits selected for the study

Keywords: Antioxidants, food sources, free radicals, fruits

Introduction

Antioxidants are substances that may protect cells from the damage caused by unstable molecules known as free radicals. Antioxidants interact with and stabilize free radicals and may prevent some of the damage free radicals might otherwise cause. Free radical damage may lead to cancer. Examples of antioxidants include beta-carotene, lycopene, vitamins C, E, A and other substances (Sies, 1997) [7]. Antioxidants existed in many dietary natural sources such as vegetables, fruits, and beverages and dietary antioxidants such as flavonoids may help reduce the risk of mortality from coronary heart disease and incidence of myocardial infarction. Furthermore, epidemiological studies and meta-analyses have suggested that the long-term consumption of plant polyphenols can protect us against a range of diseases, such as cancers, cardiovascular diseases, diabetes, osteoporosis, and neurodegenerative diseases (e.g., Alzheimer's disease). With the aging population and only a small proportion of the population has consumed daily the recommended amount of fruits and vegetables, there are great opportunities in improving the general health and against the degenerative diseases of aging by improving the diet. Vegetables and fruits are important sources of various vitamins, minerals, and fibres for humans. It is well known that fruits are rich in various antioxidants, including ascorbic acid, carotenoids, and phenolics. Some studies demonstrate that the antioxidants contained in certain fruits and Vegetables are bio available. Therefore, these fruits and vegetables can be considered as an ideal source of natural antioxidants. It is credible to speculate that increasing consumption of these fruits intentionally will increase the intake of natural antioxidants, which may provide an alternative in the intervention of the aging process by protecting against oxidative damage. Fruits are rich in antioxidants that help in lowering incidence of degenerative diseases such as cancer, arthritis, arteriosclerosis, heart disease, inflammation, brain dysfunction and acceleration of the ageing process. The most abundant antioxidants in fruits are polyphenols, Vitamin C, Vitamins A, B and E whereas, carotenoids are present to a lesser extent in some fruits. These polyphenols, most of which are flavonoids, are present mainly in ester and glycoside forms. The three major groups: vitamins, especially vitamin C; phenolics; and carotenoids, especially β -carotene is responsible for the defensive effect of antioxidants in fruits and vegetables.

Vitamin C and phenolics are known as hydrophilic antioxidants, and carotenoids are known as lipophilic antioxidants.

Sources and origin of antioxidants

Antioxidants are abundant in fruits and vegetables, as well as in other foods including nuts, grains and some meats, poultry and fish. Beta-carotene is found in many foods that are orange in colour, including sweet potatoes, carrots, cantaloupe, squash, apricots, pumpkin and mangoes. Some green, leafy vegetables, including collard greens, spinach and kale, are also rich in beta-carotene (Borek, 1991) [2]. Lutein, best known for its association with healthy eyes, is abundant in green, leafy vegetables such as collard greens, spinach, and kale. Lycopene is a potent antioxidant found in tomatoes, watermelon, guava, papaya, apricots, pink grapefruit, blood oranges and other foods. Estimates suggest 85% of American dietary intake of lycopene comes from tomatoes and tomato products (Xianquan *et al.*, 2005) [8]. Vitamin A is found in three main forms: retinol (Vitamin A1), 3,4-didehydroretinol (Vitamin A2), and 3-hydroxy retinol (Vitamin A3). Foods rich in vitamin A include liver, sweet potatoes, carrots, milk, egg yolks and mozzarella cheese (Baublis *et al.*, 2000). Vitamin C is also called ascorbic acid and can be found in high abundance in many fruits and vegetables and is also found in cereals, beef, poultry, and fish.

Vitamin E, also known as alpha-tocopherol, is found in almonds, in many oils including wheat germ, safflower, corn and soybean oils, and is also found in mangoes, nuts, broccoli, and other foods.

Types of antioxidants

Ascorbic acid

Ascorbic acid is a reducing agent and can reduce and thereby neutralize, reactive oxygen species such as hydrogen peroxide.

Ascorbic acid (vitamin C) is also an antioxidant which protects against free radicals. Vitamin C reduces the risk of upper GI tract, cervix cancer, cardiovascular diseases. It is powerful antioxidants scavenging free radicals in aqueous compartment. It is essential to convert Vitamin E free radicals to Vitamin E, as a cofactor required for hydroxylation reaction in human. The most important function of Vitamin C is key chain-breaking antioxidants in the aqueous phase. It provides stability to the cell membrane. Eriksson and Kohvakka studied the effect of Vitamin C supplementation (2 g/day for 90 days) in 56 diabetic patients; the result has shown the high-dose supplementation reduced the level of fasting blood glucose, HbA1c and improve glycaemic control. Frequent intake of Vitamin C dietary source was found to decrease the risk of Type 2 diabetes in a population-based study.

Some of the studies have been reported that diabetes may result in decreased plasma Vitamin C and E due to increased oxidative stress (Rajendiran *et al.*, 2018) [6].

Glutathione

The free radical mechanism of lipid peroxidation: Glutathione is a cysteine-containing peptide found in most forms of aerobic life. It is not required in the diet and is instead synthesized in cells from its constituent amino acids. Glutathione has antioxidant properties since the thiol group in its cysteine moiety is a reducing agent and can be reversibly oxidized and reduced. In cells, glutathione is maintained in the reduced form by the enzyme glutathione reductase

Due to its high concentration and its central role in maintaining the cell's redox state, Glutathione is one of the most important cellular antioxidants. In some organisms glutathione is replaced by other thiols, such as mycothiol in the Actinomycetes, or by trypanothione in the Kinetoplastids (Fahey, 2001) [3].

Tocopherols and tocotrienols (vitamin E)

Vitamin E is the collective name for a set of eight related tocopherols and tocotrienols, which are fat-soluble vitamins with antioxidant properties. α -Tocopherol (vitamin E) is an essential nutrient which acts as a chain breaking antioxidant preventing the propagation of free radical reactions in all cell membranes in the human body.

Vitamin E reduces the risk of oral and pharyngeal cancer, cardiovascular disease.



Psidium guajava L.

The guava, scientific name *Psidium guajava* L is one of the most gregarious of fruit trees. Chemical analysis of guava plant extract has revealed the presence of anti-microbial compounds like tannins, phenol triterpenes, flavonoids, guajivolic acid, guajavanoic acid, linolenic acid, linoleic acid, guavacoumaric acid, galacturonic acid, asphaltic acid, benzaldehyde, essential oils, saponins, carotenoid, cetin, fibre, fatty acids and a high content of vitamins C and A in its fruit.



Carica papaya

The papaya, scientific name *Carica papaya* belongs to the genus *Carica* in the myrtle family (*Caricaceae*). The papaya is a native plant of Central America but is widespread throughout tropical Africa. This highly nutritious papaya fruit has been reported to provide 26 calories, 92.1 g H₂O, 1.0 g protein, 0.1 g fat, 6.2 g total carbohydrate, 0.9 g fibre and 0.6 g ash. The fruit also contains papain which is a major component of papaya latex and is widely applied for meat tenderisation. In recent years, papain and other endopeptidases have been proven to have several medical

benefits, such as defibrinating wounds and treatment of oedemas. Tropical papaya is used to treat paediatric burns due to its proteolytic enzymes. Exception of papain, other endopeptidases, such as leukopapain and chymopapain, is also able to facilitate wound cleaning, promoting growth and improving the quality of the scar. Though *C. papaya* is an edible and flavourful fruit, it is also used for its medicinal benefits like treatment for numerous maladies, ranging from gastrointestinal disorders to asthma and sexually transmitted diseases. Often, the plant is boiled along with herbal adjuvants in order to expel worms. The leaves have also been used in infusions to treat internal parasites. Along with its use as an antihelminthic or anthelmintic, the whole fruit of *C. papaya* has also been boiled and used as an infusion in order to treat stomach ulcers. In Madagascar, a tea made of from *C. papaya* leaves has also been used in order to treat gastric ulcers as well as general gastric discomfort. In the Congolese region of Africa, a decoction made of the ripe seeds is said to be a very effective treatment of dysentery. *C. papaya* is also effective in treatment of malaria. Along with the leaves of *Azadirachta indica*, *C. papaya* has been used as a steam treatment for malaria. The fruit has also been used as a popular hepatoprotective agent. In cases of jaundice and hepatitis, immature fruit is either eaten or used in a decoction. Most studies reported that papaya fruits and its leaves had high antioxidant capacity due to their high contents of vitamin B (in leaves), vitamin C, E (in fruits), and carotenoids. Therefore, it was suggested that carica papaya unripe fruit may be useful in the management of diseases where free radicals are often generated such as diabetes, sickle cell anaemia and cardiovascular diseases. Some other ethno-medicinal uses of the fruit include diuretic, purgative, remedy for urinary conditions suggestive of gravel and stone in the bladder, gonorrhoea and leucorrhoea in women. Lycopene and citrulline have been shown to be present in this fruit and are helpful in preventing some chronic diseases. The amount of lycopene in watermelon is highly variable, but is generally more than that of tomato.



Citrullus lanatus

Watermelon (*Citrullus lanatus*) is a vine-like flowering plant native to southern Africa. Watermelon is a good source of amino acid citrulline, vitamin A, vitamin C, the antioxidant lycopene, Beta carotene and potassium. Some other ethno-medicinal uses of the fruit include diuretic, purgative, remedy for urinary conditions suggestive of gravel and stone in the bladder, gonorrhoea and leucorrhoea in women. Lycopene and citrulline have been shown to be present in this fruit and are helpful in preventing some chronic diseases. The amount of lycopene in watermelon is highly variable, but is generally more than that of tomato. Lycopene has been extensively studied for its antioxidant and cancer-preventing properties. Lycopene has been repeatedly studied in humans and found to be protective against a growing list of cancers; these cancers

now include prostate cancer, breast cancer, endometrial cancer, lung cancer and colorectal cancers. The antioxidant function of lycopene helps to protect cells and other structures in the body from oxygen damage. Protection of DNA (our genetic material) inside of white blood cells has also been shown to be an antioxidant role of lycopene.



Punica granatum

The Pomegranate, botanical name *Punica granatum*, is a fruit-bearing deciduous shrub or small tree growing between 5–8 meters (16–26 ft) tall.

The pomegranate can be made into juice or the seeds can be consumed as food. One pomegranate fruit contains around 40% of an adult's recommended daily requirement of vitamin C and is high in polyphenol compounds which have been suggested to be involved in many diseases. Pomegranate has also been used as an antihelminthic and antidiarrheal agent. The polyphenols in pomegranate are assumed to provide the anti-oxidant activity and protect low-density lipoprotein (LDL) against cell-mediated oxidation directly by interaction with the lipoprotein and indirectly by accumulation in arterial macrophages hence have anti-atherosclerotic activity. The inner and outer rinds of the fruit contain more polyphenols than the seeds and juice. In addition, pomegranate juice may cause antihypertensive effects by decreasing angiotensin-converting enzyme (ACE) activity. Atherosclerosis has been proven to retard due to the antioxidants the pomegranate juice provides. Fuhram, Volkova and Aviram (2005) tested the effects of pomegranate juice on samples on the human blood cells that were exposed to excessive physical stress and proved that the cells that were treated with pomegranate juice had less evidence of damage from the stress. Pomegranate juice consumption did not affect the sugar level of the macrophages, cholesterol or triglycerides level but it resulted in significant reduction in the serum lipid peroxides as well as cellular peroxides, hence improving the oxidative effects on the serum and macrophages, the key symptom of atherosclerosis and diabetic development. In another breakthrough, the pomegranate juice may even help decrease the birth rate of babies born with brain injuries resulting from low blood oxygen reaching the infant's brain known as Hypoxic ischemia which may lead to premature death.

Conclusion

The review of various studies suggest that antioxidants play diverse physiological role in body by inhibiting the process of oxidation, even at relatively small concentration. In human diet fruits and vegetables constitute the major sources of carotenoid. Carotenoids are thought to be responsible for the

beneficial properties of fruits and vegetables in preventing human diseases including cardiovascular diseases, cancer and other chronic diseases. Hence we can conclude that antioxidant plays an important role in our life.

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