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The Antioxidant Effect of Certain Fruits: - A Review

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Abstract:

There are innumerable fruits and vegetables which are consumed for their nutrients or for their medicinal purposes. In recent times these fruits and vegetables have been shown to possess valuable antioxidants of great nutritional and therapeutic values. 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. These fruits namely are pomegranate, guava, papaya and watermelon.

Key Words:

Free radical, anti radical, fruits.

INTRODUCTION:

Vegetables and fruits are important sources of various vitamins, minerals, and fibres for humans. However, they differ in many aspects, including the contents of vitamins, minerals, and fibres as well as their antioxidant capacity. 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 (Parashar et al., 2008b,c, 2009). 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.

Various fruits may provide protection differently against oxidative stress since they are different in antioxidant capacity. We hypothesize that fruits with high antioxidant capacity are more effective than those with low antioxidant capacity in reducing oxidative damage associated with the aging process.

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. Antioxidants are substances which when present at low concentration are able to prevent or delay oxidative damage of lipids, proteins and nucleic acids by reactive oxygen species. These reactive oxygen species mainly are reactive free radicals such as superoxide, hydroxyl, peroxyl, alkoxyl and non- radicals such as hydrogen peroxide, hypochlorous. They scavenge radicals by inhibiting initiation and breaking chain propagation or suppressing formation of free radicals by binding to the metal ions, reducing hydrogen peroxide, and quenching superoxide and singlet oxygen [1]. 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 [2]. 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. A number of researches have been made in the antioxidant capacity of fruits.

Psidium guajava L.

It is one of the most gregarious of fruit trees, the guava, *Psidium guajava* L belongs to the myrtle family (Myrtaceae). Almost universally known by its common English name or its equivalent in other languages the guava fruit, usually 4 to 12 centimetres (1.6 to 4.7in) long, are round or oval depending on the species. The outer skin may be rough, usually with a bitter taste, or soft and sweet. Guava is usually green before maturity, but becomes yellow, maroon, or green when ripe. The fruit generally have a pronounced and typical fragrance, similar to lemon rind but less sharp. Guava pulp may be sweet or sour, varying between off-white ("white" guavas) to deep pink ("red" guavas), with the seeds in the central pulp of variable number and hardness, depending on species.

Guava is a rich source of minerals like iron, calcium, and phosphorus and has many vitamins like ascorbic acid, pantothenic acid, vitamin A, carotenoids such as B-carotene and lycopene, and niacin. Single common guava (P. guajava) fruit contains about four times the amount of vitamin C as an orange [3]. The fruit has also been shown to contain saponin combined with oleanolic acid. Morin-3-

O-α-L-lyxopyranoside and morin-3-O-α-Larabopyranoside and flavonoids, phenolic compounds such as ellagic acid, anthocyanin, guaijavarin, and quercetin are also reported [3]. 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, galaturonic acid, asphaltic acid, benzaldehyde, essential oils, saponins, carofenoid, cectin, fibre ,fatty acids and a high content of vitamins C and A in its fruit [4].

The hydrophilic and lipophilic antioxidant properties of guava fruits were reported by Thaipong [5]. It was concluded from their investigation that both white and pink flesh guavas fruits had high hydrophilic antioxidant activity and compounds for phenolic and vitamin C pointed that regular consumption of guava might be beneficial to health. The hydrophilic antioxidant activity, the major activity, had high correlations with both total phenolic and vitamin C thus showing that the use of the total phenolic or vitamin C content to determine antioxidant activity level in guava fruit was executable. Phenolic and vitamin C are the better contributors to the antioxidant activity of guava fruits, compared to the contribution of carotenoids.

The guava possesses primary antioxidant potential. These primary antioxidants scavenge radicals to inhibit chain initiation and break chain propagation which is attributed to its high total phenolic compounds. Thus the guava fruit can be
harnessed either its protective or preventive roles against diseases arising from oxidative stress.

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. It develops from syncarpous superior ovary with parietal plancentation. It is most commonly known as pawpaw. 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. USDA National Nutrient database recorded an orange-fleshed papaya (per 100 g) contained 39 calories, 88.8 g H2O, 0.61 g protein, 0.14 g fat, 9.81 g total carbohydrate, 1.8 g fibre, 0.61 g ash. Additionally, Oyoyede [7] tested the chemical profile of unripe pulp of *carica papaya* and reported that the papaya fruit was very rich in carbohydrate (42.28% starch, 15.15% sugar) but low levels of fat. The fruit also contains increased levels of vitamin C (51.2 mg/100g), vitamin A precursors including β-carotene (232.3 µg/100g), and β-cryptoxanthin (594.3 µg/100g), as well as magnesium (19.2-32.7 mg/100g), which has been reported by Wall [8]. 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 [9]. 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. The variations in the papaya fruit are due to various cultivars.

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 [10]. The leaves have also been used in infusions to treat internal parasites [11].

Along with its use as an antihelminthic, 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 [12]. In the Congolese region of Africa, a decoction made of the ripe seeds is said to be a very effective treatment of dysentery [13]. *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 [11].

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 [10]. 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 [6, 13, 14].

Recently Oloyede *et al* [15] put forward the antioxidative properties of ethyl acetate fraction of unripe pulp of carica papaya in mice. Quercetin and β-sitosterol were isolated from the methanolic extract and later from the liquid-liquid extract of unripe carica papaya fruits using soxhlet apparatus. They further investigated the in vitro antioxidant properties of this fruit in mice and the result concluded a significant increase ($p<0.05$) in the activities of Glutathaione reductase, Glutathione peroxidase, Glutathione, and Glucose-6-phosphate dehydrogenase with a little reduction in catalase activity in the ethyl acetate fraction in the liver. No significant change in activities of GR, GST and CAT were found in groups of animals administered ethyl acetate (100mg/kg) or Aqueous extract when compared to control that received distilled water only, but renal GPx activity decreased following administration of ethyl acetate fraction. It was likely that quercetin and β-sitosterol were probably responsible for the antioxidant potential demonstrated by the ethyl acetate fraction from unripe fruit. 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.

Citrullus lanatus

Watermelon (*Citrullus lanatus*) is a vine-like flowering plant native to southern Africa. The watermelon fruit usually considered a type of melon has a smooth exterior rind(green, yellow and sometimes white) and a juicy, sweet interior flesh usually deep red to pink but sometimes orange, yellow and even green if not ripe. Water melon rinds are also edible but are mostly avoided due their unpleasant flavour. *C. lanatus* is an annual herb with long (up to 10 m) stems lying or creeping on the ground, with curly tendrils. Leaves are 5-20 by 3-19 cm, and hairy and usually deeply palmate with 3-5 lobes on 2-19 cm long petioles. Fruit size ranges from about 7cm in diameter to over 20cm. In addition, their colour ranges from pale yellow or light green (wild form) to dark green (cultivars), and with or without stripes; the pulp varies from yellow or green (wild forms) to dark red (cultivars). The flesh amounts to about 65% of the whole fruit and 95% of the flesh are water.

Water melon is a good source of amino acid citrulline, vitamin A, vitamin C, the antioxidant lycopene, Beta carotene and potassium. Cucurbitacin has diuretic and purgative properties. The fruit has but few medicinal uses. Bitter forms are used in Senegal as a drastic purge and are considered poisonous [16]. 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 [17, 18]. Lycopene and citrulline have been shown to be present in this fruit and are helpful in preventing some chronic diseases [19]. The amount of lycopene in watermelon is highly variable, but is generally more than that of tomato. Citrulline is present in all parts of the fruit [20]. Lycopene was found to be relatively stable in fresh cut watermelon, and could increase slightly in whole fruit held at room temperature [21]. Seedless watermelon generally has more lycopene than seeded types, and lycopene present in red fleshed fruit, with small amounts in orange fleshed watermelon, and none in yellow fleshed types.

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 [22, 23]. 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 [24]. The amino acid citrulline in watermelon is a known stimulator of nitric oxide. Nitric oxide is known to relax and expand blood vessels much like the erectile dysfunction drug Viagra and may increase libido [25]. The health benefit of watermelon fruit is associated with its powerful antioxidant properties as found in vitamin A, lycopene and beta carotene which help to neutralize free radicals hence can be use in the the prevention of diseases associated with oxidative stress such as diabetes, asthma, atherosclerosis.

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 is widely considered to have originated in the vicinity of Iran and has been cultivated since ancient times.[26,27,28,29] Today, it is widely cultivated throughout the Mediterranean region of southern Europe, the Middle East and Caucasus region, northern Africa and tropical Africa, the Indian subcontinent and the drier parts of southeast Asia[29]. 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 *Punica granatum* leaves are opposite or sub-opposite, glossy, narrow oblong, entire, 3–7 cm long and 2 cm broad. The flowers are bright red, 3 cm in diameter, with four to five petals (often more on cultivated plants). Some fruitless varieties are grown for the flowers alone. The edible fruit is a berry and is between a lemon and a grapefruit in size, 5–12 cm in diameter with a rounded hexagonal shape, and has thick reddish skin. The exact number of seeds in a pomegranate can vary from 200 to about 1400 seeds.[30] Each seed is surrounded by a watery pulp — the edible aril — ranging in color from white to deep red or purple. The seeds are embedded in a white, spongy, astringent membrane.

Pomegranates are widely acknowledged for their antioxidant properties which are more than other fruits items. Among them are blueberry, cranberry, and red wine and green tea which is recommended by doctors to all of their patients.

The pomegranate plant contains alkaloids, mannite, ellagic acid, and gallic acid, and the bark and rind contain various tannins having properties such as being water soluble. 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.

Tests were conducted by them in another study for the possible effects of pomegranates on diabetes. The disease is associated with oxidative stress on the macrophages, white blood cells and serum- the liquid portion of the cells left after cells and clotting factors are removed. 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. A study was conducted in vivo in mouse samples and it was found out that 60% of brain tissue that was lost was recovered in the samples that were given pomegranate juice. Hence not only does pomegranate provide a possible cure for diabetic patients, patients with high blood pressure, patients with atherosclerosis and infants with brain damage but it may even provide a very inexpensive, safe and 100% natural way of healing.

CONCLUSION:

The fruits described in this review indicate the importance of antioxidants and their nutritional importance. Researches are being conducted in this field to know more about these antioxidative fruits and their contribution in preventing early onset of disorders like myocardial infaction, hypoxic ischaemia, coronary heart disease, atherosclerosis, erectile dysfunction in males.

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