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Author(s): Aqsa Sajjad, Shabbir Hussain, Shumaila Zulfiqar Butt, Muazzam Ali Muazzam

Affiliation: Department of Chemistry, Lahore Garrison University, Lahore, Pakistan

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Aqsa Sajjad

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An Overview of Antioxidant and Pharmacological Potential of Common Fruits

Aqsa Sajjad, Shabbir Hussain*, Shumaila Zulfiqar Butt, Muazzam Ali Muazzam

Department of Chemistry,
Lahore Garrison University, Lahore, Pakistan

*dr.shabbirhussain@lgu.edu.pk; shabchem786@gmail.com

Abstract

This research was conducted to evaluate the antioxidant and pharmacological potential of numerous common fruits. Prunus domestica (Prunes) are excellent sources of dietary antioxidants and cause the lowering of LDL cholesterol plasma level. Strawberries (Fragaria ananassa) have ascorbic acid content (5-50 mg/100 g of fresh weight) and are effective in the treatment of oral cancer and cardiovascular diseases. Citrus fruits (Citrus limon) are rich in flavonoids (naringin and hesperidin), polyphenols and vitamin C; the extracts of citrus peels are effective against food borne bacteria. Lime oil from Citrus aurantifolia has been used as a component of skin care products and to impart taste and flavor in the food industry. Grapes (Vitis vinifera) are rich in phenolic compounds and are active against cancer, cholera, smallpox, nausea, eye infections and skin/kidney/liver diseases. Blackberry (Rubus ulmifolius) contains polyphenol ingredients and has neuroprotection potential against age-related diseases. Different parts of Jamun or Java Plum (Syzygium cumini) demonstrate an excellent antioxidant and antimicrobial potential and are used as a remedy for diabetes mellitus, leucorrhea, fever, constipation and gastropathy. Ziziphus mauritiana (Jujube) consists of cyclopeptide alkaloid, lupine and ceanathone triterpenes. It can be used in sedatives and analgesic; and exhibits excellent antibacterial and antioxidant potential. Vaccinium oxycoccus (cranberries) have 10mg/100g of ascorbic acid content and its extract can prevent urinary tract infections.

Keywords**:** aging, antioxidant, diseases, fruits pharmacological

Introduction

Plants are well known for their nutritional and medicinal value [1-3].

Different parts of the plant (root, stem, leaves, flowers and fruits) are rich in antioxidants and antimicrobial contents [1, 4]. Fruits have an immense significance in the lives of human beings. Besides their delicious taste, fruits contain a lot of natural organic products having an excellent nutritional value. Organic products are necessary for the proper healthy growth of a body. They prevent the body from various ailments and act as a shield against cancerous and microbial diseases [5]. They have the ability to defend the body against malignant growth, other degenerative ailments [6] and oxidative harm. It is worth mentioning that oxidative species can cause huge harm in the body [7] and may lead to cardiovascular ailments, malignant growth, diabetes, Alzheimer's infection, waterfalls, chemical imbalance and maturing [8].

Present studies were focused to evaluate the antioxidant and pharmacological properties of fruits of *Prunus domestica* (prunes), *Fragaria ananassa* (strawberries), *Citrus limon* (citrus), *Citrus aurantifolia* (lime), *Vitis vinifera* (grapes), *Rubus ulmifolius* (black berries), *Syzygium cumini* (java plum), *Ziziphus mauritiana* (ber) and *Vaccinium oxycoccus L.* (cranberries). The fruits are rich in lycopene, anthocyanins, flavanols and flavanone.

2. Antioxidants and Pharmacological Potential of Fruits

There is an important relationship of diet with aging and has been extensively investigated. Healthy foods, in addition to the provision of dietary antioxidants, can delaying the process of aging. Healthy foods, including fruits, are important sources of natural bioactive compounds and dietary nutrients and possess antioxidant potential to prevent aging and other age-related disorders. Numerous health benefits are associated with intake of fruits, as reported in large number of earlier studies. They reduce the formation of free-radicals and thus suppress the oxidative stress created in the human body and also prevent aging. The fruits like cherries, grapes, berries, oranges and apples are important sources of natural antioxidants such as anti-aging phytochemicals (e.g., quercetin, resveratrol used to delay the aging process), minerals, vitamins, phenolic, anthocyanins [9]. Fruits also provide protection against numerous diseases including cardiovascular diseases, inflammatory disorders, type 2 diabetes and cancer. In addition to this, fruits also improve the health and pharmacological potential including neuroprotective, anti-diabetic, anti-cancerous and anti-inflammatory usage [9].

Some important antioxidants of plants are discussed below:

2.1. Lycopene

Lycopene is a plant nutrient having excellent antioxidant potential. It is a pigment which gives pink and red colour to fruits such as pink grape fruit, water melons and tomatoes [10]. Lycopene is very much effective against issues related to obesity; it also reduces the risk of skin malignant growth and prostate diseases in men. An abundant quantity of lycopene is present in tomatoes and its bioavailability is increased by heating the tomatoes in cooking oil [11].

2.2. Anthocyanins

Anthocyanins are natural pigments which belong to the group of flavonoids and are responsible for the taste and colour of many vegetables and fruits [12]. Anthocyanins possess an excellent antioxidant potential against oxidants like reactive oxygen species. Researches have shown that anthocyanin is highly beneficial in protecting the pancreas from oxidation and hence, it prevents the body from diabetes [13]. However, anthocyanin shows inhibitory effects against some digestive enzymes such as α-amylase and maltase. Due to this inhibitory action, absorption of glucose in intestinal portion is decreased which in return decreases the postprandial blood glucose [14, 15]. Anthocyanins are water-soluble pigments characterized by a shift in hue from red to purple or blue depending on the pH of the cellular fluids. Anthocyanins assist in enhancing the elasticity of vascular wall and improve blood circulation, promote cardiovascular health and improve night vision [11].

2.3. Flavanols

Many fruits like apple, Chinese bayberry and grapes are enriched with flavanol compounds. Flavanols show many properties like antihyperglycemic, antioxidant and antimicrobial. They also show inhibitory action against α-glucosidase [14]. In addition to this, they also lower the blood glucose level which in fact reduces the rate of diabetes [16].

2.4. Flavanone

Flavanones occur in tangerines, oranges, tangors, tangelos and citrus fruits [17, 18] and are the bioactive compounds which show good antioxidant and antimicrobial effects. It has been proven in many studies that flavanone shows good results against the diabetes due to its inhibitory effects on many enzymes [19].

3. Common Fruits and Antioxidant Potential

3.1. *Prunus domestica* (Prunes)

The scientific name of Prunes is *Prunus domestica* (Figure 1). The active compounds in prunes decreases the LDL cholesterol plasma level in patients with hypercholesterolemia [20]. Prune and prune juices are excellent sources of dietary antioxidants [21]. It has been reported that prune fiber causes lowering of plasma and liver cholesterol level in hyperlipidemic rats [22]. The oxidation of low-density lipoproteins (LDL) is inhibited by pitted prune extracts [21].

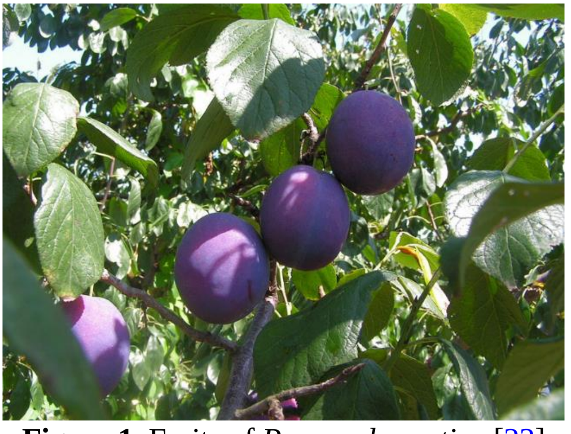

Figure 1. Fruits of *Prunus domestica* [23]

3.2. *Fragaria ananassa* (Strawberries)

Strawberry (*Fragaria ananassa,* Figure 2) is cultivated all over the world due to its medicinal, antioxidant and antimicrobial potential. A lot of research has been made on this plant. Strawberries have a very high amount of ascorbic acid; they have four times more ascorbate content than blue berries. In strawberries, the ascorbate content ranges from 5-50 mg/100 g of fresh weight [24]. Improvement in oral cancer by using strawberries has also been noted [25]. The risk of cardiovascular diseases is lowered by the antioxidants present in strawberries [26].

Figure 2. Fruits and flowers of *Fragaria ananassa* [27]

3.3. *Citrus limon* (Citrus)

Naringin and hesperidin are among the most important and notable flavonoids that are reported in citrus fruits (*Citrus limon*, Figure 3). These flavonoids have been extensively used for treatment of cardiovascular diseases. Hesperidin is contained in oranges, tangerines, lemons and limes. The extracts of citrus peels have appeared to be highly effective against food borne bacteria [28]. The fiber of citrus fruit contains bioactive compounds, such as polyphenols, like vitamin C (or ascorbic acid) and cure vitamin C deficiency which causes scurvy [29].

Figure 3. Ripe lemons on *Citrus limon* [30]

3.4. *Citrus aurantifolia* (Lime)

Lime fruits (*Citrus aurantifolia*, Figure 4) are widely cultivated throughout the world and are commonly known as meetha in Pakistan [31]. The plant contains numerous secondary metabolites, triterpenoids, phenolic acids, flavonoids, essential oils, coumarins, carotenoids and alkaloids which are medicinally important. Aromatic compounds (e.g., monoterpenes and their derivatives, alcohols, esters, ketones, aldehydes) such as citral (4.4%), γ-terpinene (8.5%), γ-terpinene (8.5%) and limonene (58.4%) are abundantly present in citrus oil. Oil is mainly extracted by hydrodistillation of fruit and peel. The presence of limonoids owes aroma and bitter taste to the citrus fruit peels. Lime oil (essential oil) has been used in traditional medicines and as a component of skin care products due to its potent antifungal and antibacterial properties. It also finds applications in food industry to impart citric flavour to cuisines. Its oil and juice also display multiple biological effects including hepatoprotective, antityphoid, hypolipidemic, anti-inflammatory, antiulcer, antioxidant, antimicrobial properties [32]. Some compounds derived from the lime were successful against *Pseudomonas Aeruginosa* and *Aspergillus niger*. Highest action of the natural product oil was seen against the parasites *Candida spp* and *Aspergillus niger* [33,34].

Figure 4. Fruit of *Citrus aurantifolia* [35]

3.5. *Vitis vinifera* (Grapes)

*Vitis vinifera (*grapes, Figure 5) are rich in phenolic compounds and almost 75% of polyphenols exists in the skin and seeds [36]. Grapes are beneficial for numerous health problems including cancer, cholera, smallpox, nausea, eye infections and skin/kidney/liver diseases [37]. Grape seed extracts can be used as a dietary supplement in the form of capsules, tablets and liquid form. Grapes have active ingredients which possess pharmacological activities such as anti-inflammatory, anticancer, antifungal, anti-bacteria and antioxidant [38].

Figure 5. Fruits of *Vitis vinifera* [39]

3.6. *Rubus ulmifolius* (Blackberries)

Blackberry (*Rubus ulmifolius*, Figure 6) has been used from a long time in medicine [40]; its leaves demonstrate antimicrobial and anti-inflammatory potential [41]. *Rubus ulmifolius* contains polyphenol ingredients which show good antioxidant potential [42]. Blackberries contain compounds which possess neuroprotection potential against age-related diseases [43]. Digested metabolites from wild blackberries protect neuronal cells against oxidative damage and also possess anti-inflammatory properties [44].

Figure 6. Fruits on the branches of *Rubus ulmifolius* [45]

3.7. *Syzygium cumini* (Java Plum)

Java Plum (*Syzygium cumini*, Figure 7) is a common fruit which is found everywhere in the world. It is small in size but enriched in natural antioxidant and antimicrobial compounds [46]. The plant of the Java Plum is known to possess diverse phytochemicals, most of which are observed to have health benefits. Its leaves have been said to possess natural antimicrobial and antioxidant compounds, and are known to contain several flavanols like β-sitosterol, quercetin, myricitrin, the flavanol glycosides, and acylated flavanol glycosides [47]. Different parts of its plant have been used in ayurvedic medicine as a remedy for diabetes mellitus [48]. The leaf extract is beneficial for strengthening the gums and teeth and also used to treat leucorrhea, fever and gastropathy [49]. It also finds applications to treat constipation due to the laxative effect and in treating the blood discharged in the feces [50].

Figure 7. Fruits on the branches of *Syzygium cumini* [51]

3.8. *Ziziphus mauritiana* (Jujube)

Ziziphus mauritiana (Jujube, Figure 8) is an important medicinal and traditional plant [52] and is commonly known as Ber plant in Pakistan's national language. This plant consists of cyclopeptide alkaloid, lupine and ceanathone triterpenes. These chemicals show intense biological activities such as sedatives, analgesic and antibacterial [53]. It is reported that different antimicrobial activities against different microorganisms are possessed by extract of *Z. mauritiana* leaves. Numerous antimicrobial components are present in *Z. mauritiana* plant which can be used for the therapy of microbial infections [54]. *Z. mauritiana* indicates high antioxidant potential and also shows high H_2O_2 scavenging activity as it contains a high amount of total proteins, reducing sugars, flavonoids, ascorbic acid contents, β-carotene, polyphenols, tannins and DPPH free radicals [55,56]. It is reported that methanolic seed extracts of this plant are markedly valuable against the cancerous cell lines. Also ethanolic extracts of seed markedly inhibit the proliferation of HL60 cells [57].

Figure 8. Fruits on the branches of *Ziziphus mauritiana* [58]

3.9. *Vaccinium oxycoccus* (Cranberries)

Vaccinium oxycoccus (Cranberries, Figure 9) have biologically active compounds; vitamin C is a major component of Cranberries. On average ranberries have 10mg/100g of ascorbic acid content [59]**.** Cranberry juice intake significantly increases the plasma level of antioxidants up to 7h [60]. Cranberry extract can prevent urinary tract infections [61].

Figure 9. Fruits on the branches of *Vaccinium oxycoccus Var* [62].

4. Conclusion

Prunus domestica (Prunes), *Fragaria ananassa* (Strawberries), *Citrus limon* (Citrus), *Citrus aurantifolia* (Lime), *Vitis vinifera* (Grapes), Rubus *ulmifolius* (Blackberries), *Syzygium cumini* (Java Plum), *Ziziphus mauritiana* (Jujube) and *Vaccinium oxycoccus L.*

(Cranberries) contain valuable nutritional, antioxidant and antimicrobial contents and find applications in food and pharmaceutical industry. The fiber derived from the fruits contains useful components which can be employed in the pharmaceutical industry as food supplements. Fruits are reported to be rich in lycopene, anthocyanins, flavanols and flavanone. They provide dietary antioxidants and delay the process of aging. Fruits possess neuroprotective, anti-diabetic, anti-cancerous, anti-inflammatory potential and are also helpful against numerous diseases including cardiovascular diseases, inflammatory disorders, type 2 diabetes and stomach disorders.

All the selected intersections currently have fixed-time signal control systems. The actuated-signal control type proved to be an effective strategy in mitigating traffic congestion. In the actuated-signal control system, the sensors detected the longest traffic queue on the approaching leg based on infrared radiations and the signal facing the most traffic turned to green allowing the traffic to pass through. This simulation study can be used as an important tool to assess the performance of different intersections in given circumstances. However, actuated-signal control systems should be implemented without much delay as it is the last option to implement, and a special preemption should be given to the emergency vehicles for the safety improvement of the residents and commuters. This research study was carried out on a local scale and may not represent the actual reasons for traffic delay. Therefore, an extended research study is required to include a broader study area so that some valid conclusions could be made, and relevant suggestions are proposed.

However, the policymakers and traffic planners can get some insights from this research study: how the introduction of actuated- signal control can be used as an estimation for smooth flow and proper resource allocation. This study can help the authorities in mitigating traffic congestion problems for Lahore city and can give insights to policymakers in case of extension of the current route due to increased traffic demand in the future.

Conflict of Interest

The author declares no conflict of interest.

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