

Study of berries - A short review

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ABSTRACT

Berry is a common edible fruit. The main or the most important components of the berries are composed antioxidants, phytochemicals, flavonoids, carotenoids, polyphenols, vitamins (mainly Vitamin C), and minerals. These components of the berries are commonly used for their anti-inflammatory and antioxidant properties and known to be of major benefit to the human health. In addition to antioxidants, berries are “juicy foods,” which means they contain mostly water, and they smell delicious. Vitamin C is a strong antioxidant found in berries. Eating Vitamin C - rich berries will contribute to radiant skin and healthy hair and may reduce the risk of arthritis, cataracts, and macular degeneration. Some people with IBS experience discomfort after eating berries. However, In this review, we are going to do a study of the berries - strawberry, raspberry, blueberry, gooseberry, and hawthorn.

KEY WORDS: Antioxidant, Berry, Blueberry, Phytochemicals, Raspberry, Strawberry

INTRODUCTION

Berries are fruits that possess pharmacological and biochemical properties. They have a high content of bioactive compounds which provide a spectrum of benefits such as protection against cardiovascular, neurological and lung diseases as well as anti-inflammatory, antimicrobial, antidiabetic, and anti-aging properties. The most abundant bioactive compounds are phenolic acids, tannins, and flavonoids, especially anthocyanins which gives the attractive color for the berries. Among the world berry production, strawberries, raspberries, and currants account for almost 80% of the production.

Blueberry is one of the oldest fruits and has medicinal purposes. It is rich in phenolics, especially in anthocyanins.^[5] Blueberry is native to North America. It has two different species, low sweet (*Vaccinium angustifolium* Ait.) and sour-top or velvetleaf (*Vaccinium myrtilloides* Michx.).^[6] They have become

popular among consumers as research findings show that their consumption improves human health.^[3]

Strawberry (*Fragaria × ananassa* Duch.), a member of the Rosaceae family, is one of the most important soft fruits in the world. There are about 20 different recognized species. Strawberries are good sources of natural antioxidants. The most commonly cultivated species is *Fragaria ananassa*.^[7]

Raspberry (*Rubus* sp.) is a naturally growing in Arasbaran. It is known by recent works that raspberries in particularly high not only in anthocyanin content but also in total phenolics.^[15] Raspberry fruits can be red, black, purple, or yellow. Most commercial raspberries grown in the Pacific Northwest are red fruited.^[14] Raspberries have been linked to many possible health benefits.^[15]

Gooseberry belongs to family Euphorbiaceae. They are commonly distributed in tropical and subtropical areas. It is widely used in Ayurvedic medicines. According to ancient Indian mythology, it is the first tree to be created in the universe. Amla is used as a rejuvenator for the organ systems of the body; it may be called as “King of Rasayana” (rejuvenation) due to its health benefits.^[22,23]

Access this article online

Website: jprsolutions.info

ISSN: 0975-7619

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Received on: 23-08-2018; Revised on: 22-09-2018; Accepted on: 26-10-2018

Hawthorn is a common name of all plant species in the genus *Crataegus*. It is a thorny shrub or small tree that has bright green leaves, white flowers, and bright red berries, containing one to three or five seeds, depending on the species. Hawthorn is a member of the Rosaceae family and is said to have about 280 species from northern temperate zones in East Asia, Europe, and Eastern North America. This herb is largely used for preventing and treating cardiovascular diseases (CVDs). The fruit of the plant called hawthorn berries has several properties and is of significant biological importance for its antioxidant and microbiological properties.^[24]

BLUEBERRY

Blueberries are popular among the public due to the health benefits and improvement provided on consumption of them.^[1] It can be consumed in both fresh and processed forms. The major production of blueberry is found in two places namely, the United States which is responsible for 66% and Canada which is responsible for 33% of world production.^[2] It was an unknown fruit in Brazil, and its introduction in that country began in the second half of 80 s.^[3] However, now it has become a blueberry producer with a small production concentrated in the south and southeastern regions of the country, in the municipalities of Vacaria and Caxias do Sul (Rio Grande do Sul, RS), Barbacena (Minas Gerais, MG), and Campos do Jordão (São Paulo, SP).^[2] The different species of blueberry are highbush (*Vaccinium corymbosum*), lowbush (*V. myrtilloides* and *V. angustifolium*), and rabbiteye (*Vaccinium ashei*) (Caruso and Ramsdell 1995). Moreover, out of these, Highbush blueberries are the most commonly cultivated.^[4]

The health benefits are attributed to the phenolic content in blueberries. Out of the total phenolics found in blueberries, anthocyanins represent 57–93%.^[5] The major anthocyanins for blueberries are, namely malvidin 3-galactoside and malvidin 3-glucoside in blueberries.^[5] These phenolics have a wide spectrum of biochemical activities such as antioxidant, antimutagenic, abilities to modify gene expression, as well as cardiovascular protection, antidiabetic properties, vision improvement properties, and inhibition of carcinogenesis.^[3]

STRAWBERRY

Strawberries are an important common seasonal fruit consumed by the public. Their increased consumption rate may be due to the presence of high content of essential nutrients, desirable flavor, and high visual appeal. It is mostly consumed fresh, but as it has a short shelf life, highly perishable, and seasonal nature, part of the fruit production is processed. They can be

used as an ingredient for the production of alcoholic beverages, jams, jellies and marmalades, pies, ice-creams, yogurts, etc.^[4] They are also used in medicine as antiseptics, diuretics, and laxatives. The strawberry has a rich secondary metabolite composition in particular.^[8] Strawberry is majorly composed of phenolic compounds which are the flavonoids, which are mainly anthocyanins, with flavonols, and flavanols providing a minor contribution, and then followed by hydrolyzable tannins which are ellagitannins and gallotannins and phenolic acids such as hydroxybenzoic acids and hydroxycinnamic acids, with condensed tannins (proanthocyanidins) being the minor constituents.^[8] Due to these compounds, the fruits provide a high level of scavenging activity toward chemically generated radicals and act against oxidative-related diseases.^[8]

The beneficial advantages of strawberries are their role in the prevention of inflammation, oxidative stress, and CVD, certain types of cancers, type 2 diabetes, obesity, and neurodegeneration.^[10]

Strawberries inhibit different types of cancer cell transformation and proliferation *in vitro* and in decreasing the early and late progression of experimentally induced tumors. Therefore, strawberry extracts protect against carcinogenesis.^[10]

RASPBERRY

Raspberry (*Rubus idaeus* L.) is a fruit which is grown as a perennial crop. It belongs to the genus *Rubus*. Raspberries are a soft, juicy fruit with a definite aroma.^[17] There are about 200 raspberry species, and most of these have red berries (European), while some have blackberries (American). The red raspberries originate from Asia. The species was named after Mount Ida by Linnaeus.^[11] These fruits are industrially used in formulating jam, jelly, sauce, puree, topping, syrup or juice concentrates, etc. Raspberries are rich in potential antioxidant phenolic compounds, and the major group of phenolic compounds present is anthocyanins, flavonols, ellagitannins, gallotannins, proanthocyanidins, and also Vitamin C and E.^[12] The major anthocyanins and tannins are cyanidin-3-sophoroside, cyanidin-3-glycoside, pelargonidin-3-glucoside, and hydrolyzable tannins. They have major curative roles also such as antioxidant, anti-inflammation, low body weight, and inhibitory cancer cell growth reducing eye strain, improving night vision, helping to prevent macular degeneration, anti-inflammatory effects, protecting against DNA damage, and exhibiting anti-cancer activity.^[13] Moreover, they also contain salicylic acid which have protective effects similar to aspirin which prevent heart disease in those at high risk or who have heart disease.^[16]

GOOSEBERRY

Indian gooseberry (*Phyllanthus emblica*) also referred to as Amla is a small, light green, spherical fruit with six vertical stripes and a hard seed inside. In Sanskrit, it is called Amalaki or Dhartiphala, which means “the sustainer.” It has a sour taste. It is commonly grown in Southeast Asia. There are two varieties of Amla, cultivated Amla which is big, smooth, and juicy, and wild Amla which is small. It contains the highest proportion of Vitamin C, almost 20 times more than an orange. The Vitamin C content given out is more in sun-dried Amla than in fresh Amla. In the composition of Amla, about 80% of it is made of water. The other components are quercetin, phyllaemblic compounds, gallic acid, tannins, flavonoids, pectin, and various polyphenolic compounds. It can be used as an ingredient in food or just as a medicine. The health benefits are antioxidant, anticarcinogenic, antitumor, antidiabetic, anti-inflammatory activities, antigenotoxic, diuretic activity, detoxifying effect, strengthening of body organs, and strengthening of immune cells. Amla is known mainly for its anti-aging property (slowing find aging process). Aging is a process which results from damage to various cells and tissues by oxygen free radicals. Vitamin C acts as a scavenger of free radicals and breaks them down. The antioxidant property contained in Amla helps correct liver toxins, high blood cholesterol, and age-related kidney disorders. In addition to the above benefits, it also enhances food absorption, balances stomach acid, nourishes the brain and mental functioning, useful in memory enhancing, supports the heart, strengthens lungs, enhances fertility, helps urinary system, promotes skin health and healthier hair, acts as a body coolant and flushes toxins, ophthalmic disorders, lowering cholesterol level, and also helpful in neutralizing snake venom. It is used more often as a herbal medicine for fever reduction, cough, and sore throat and immune system inducer. As it has no adverse or negative affects, it can be consumed on a regular basis and can be considered as a safe medicine.^[18-23]

HAWTHORN

Crataegus pinnatifida (Chinese hawthorn), *Crataegus pubescens* (Mexican hawthorn), *Crataegus cuneata* (Japanese hawthorn), *Crataegus laevigata* and *Crataegus monogyna* (Europe), *Carthamus oxycantha* and *Crataegus aronica* (Middle East), *Crataegus phaenopyrum* (American hawthorn), and *Crataegus ambigua* (Russian hawthorn) are few of the Hawthorn species used in medicine for treating CVDs.^[24]

The parts of the hawthorn which are useful such as leaves, flowers, and berries contain a range of bioflavonoids that appear to be the primary reason for the cardiac actions of the plant. The bioflavonoids found in hawthorn plant include oligomeric procyanidins, vitexin, quercetin, and hyperoside, the other chemical constituents include Vitamin C,

saponins, tannins, cardiogenic amines (phenylethylamine, tyramine, isobutylamine, O-methoxyphenylethylamine, choline, and acetylcholine), purine derivatives (adenosine, adenine, guanine, caffeic acid, and amygdalin), triterpene acids, and ursolic acid.^[25,26] Hawthorn exerts a wide range of pharmacological properties, especially on the cardiovascular system, including cardiogenic, antiarrhythmic, hypotensive, hypolipidemic, and antioxidant activities.^[25] The flavonoids present account for the red color of hawthorn berries. Dried flower and fruits of hawthorn are prepared as a tea and used to treat tonsillitis, coughing, poor coronary activity, cardiac pain, tachycardia, renal diseases, arteriosclerosis, liver pain, and hemorrhoids.^[27] Proanthocyanidins, a group of flavonoid compounds in hawthorn berries are credited for the antioxidant and anti-inflammatory actions. Hawthorn fruit is a traditional wild food in Asia, Europe, and North America for making teas, cordials, and other drinks as well as being a traditional heart remedy.^[28]

C. monogyna fresh fruit extracts are a rich source of polyphenols and proanthocyanidins.^[29]

Crataegus pinnatifida is an edible fruit used in traditional Chinese medicine to lower plasma lipids. *C. aronica* fruits exerted hypolipidemic potential.^[25]

The fruit/berry extracts of the *Crataegus oxyacantha* L., another species of hawthorn, comprise a large proportion of polyphenolic compounds, hence the presence of good antioxidant and antimicrobial activities.^[30]

Heart problems such as irregular heartbeat, high blood pressure, chest pain, hardening of the arteries, and heart failure can be treated by hawthorn berries. They have a beneficial effect on cardiac arrhythmias. They can be used as a long-term treatment for failing or weak hearts this can be done as the heart circulation can be improved by action on the heart, either by stimulating or depressing its activity depending on the need. This leads to dilation of the coronary blood supply and the tendency to slow down or stabilize the contractility of the heart muscle hence.^[31,32]

Hawthorn berries have an action on elevated levels of pyruvic and lactic acid in blood by reducing them. They also act on normalization of prolonged systole and prevention of electrocardiography changes due to hypoxia. Hence, all these properties can define hawthorn as an extremely useful herb for a strong and healthy heart.^[31,32]

HEALTH BENEFITS OF BERRIES

Berries possess several health benefits. The health benefits are mainly due to the polyphenol contents and Vitamin C in berries. The polyphenolic antioxidants are considered as disease fighters that protect the body against free radicals or unstable molecules that

cause cell damage leading to chronic and degenerative diseases. The most predominant polyphenols in berries are anthocyanins. The anthocyanins act as cardio protectants and are superior to other drugs as they maintain vascular permeability, reduce inflammatory response, and platelet aggregation. They also reduce oxidative stress and inflammation.

Polyphenols are considered to be involved in nonspecific anti-adhesion effects against oral bacteria. Extracts of several berries (black current, cranberry, crowberry and lingonberry, and bilberry) exhibit anti-adhesion activity against a human pathogen *Neisseria meningitidis*.^[33] Cranberry constituents are able to inhibit and reverse the coaggregation of dental plaque bacteria (antiaggregation).

Cranberry in specific has been reported to possess compounds suppressing adhesion and control the growth of *Listeria monocytogenes*, *Helicobacter pylori*, *Campylobacter jejuni*, *Escherichia coli*, and *Salmonella enterica* sv. It is also bacteriocidal against *Staphylococcus aureus*.^[34,35]

Berries and their extracts have a beneficial effect on diabetes, memory enhancement, neurodegenerative diseases of aging, radiation protection, and as an anti-influenza agent.

CONCLUSION

Hence from this, we conclude that berry is a very useful fruit. They are full of bioactive compounds such as antioxidants, phytochemicals, flavonoids, carotenoids, polyphenols, vitamins, and minerals which provide several health benefits as mentioned above. Moreover, this review also shows the properties and the functions of the three most important berries which are very useful to man.

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Source of support: Nil; Conflict of interest: None Declared