



Phytochemical Profile of Blueberries : And Overview

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ABSTRACT

Blueberries are the edible fruits from the *Vaccinium angustifolium* plant. Blueberry is a common food and is also sometimes used as medicine. Blueberries are high in fiber, which can help with normal digestion. A single blueberry bush can produce as many as 6,000 blueberries per year. British Columbia is the largest highbush blueberry growing region in the world. Blueberries are a popular, delicious fruit. They are a good source of vitamin K1, vitamin C, manganese, and several other beneficial plant compounds like anthocyanins, flavonoid, polyphenolic. Eating blueberries on a regular basis may prevent heart disease, improve brain health, ability to various skin problems, and help moderate blood sugar levels. Blueberries are believed to have one of the highest antioxidant levels of all common fruits and vegetables. The main antioxidant compounds in blueberries belong to a family of polyphenols antioxidants called flavonoids. Blueberries are help to protect against aging, cancer and damage to your DNA. "A standard serving of 100 grams (3/4 of a cup) provide 65 calories and 15 grams of carbohydrates. The Blueberries are Antioxidant 'superfood' packed and phytoflavinoid, these berries are also high in potassium and vitamin C, making them the top choice of doctors and nutritionists. Not only can they lower your risk of heart disease and cancer, they are also anti-inflammatory. Blueberries are one of the healthiest fruits.

I. INTRODUCTION

Blueberries are a widely distributed and widespread and group of perennial flowering plants with blue or purple berries. They are classified in

the section *Cynococcus* within the genus *Vaccinium*, [Family : Ericaceae](1) Commercial blueberries are both wild means lowbush and cultivated means highbush are all native to North America. The highbush varieties were introduced into Europe during the 1930.(2)The commercial production of blueberries, the species with small, pea-size berries growing on low-level bushes are known as "lowbush blueberries. while the species with larger berries growing on taller, cultivated bushes are known as "highbush blueberries."(3) Canada is the leading producer of lowbush blueberries, while the United States produces some 40% of the world supply of highbush blueberries.(4)The highbush blueberry is a major crop cultivated in the United States, Canada, Europe, Australia, New Zealand, Chile and Argentina. The rabbit eye blueberries are commercially produced in south eastern United States.(5)The commercial production of lowbush blueberries is largely confined to Maine [the United States] and Quebec and the Maritime provinces in Canada(6). Blueberries contain 3.5% cellulose and 0.7% soluble pectin. More than 10% of fresh weight of the blueberry is composed of the total sugars. Glucose and fructose constitutes the predominant reducing sugars in blueberries. The acid content of ripe blueberries ranges from 1% to 2% and citric acid forms the primary organic acid in blueberries. Blueberries contain high levels of the amino acid arginine. Blueberries contain 22.1 mg of vitamin C per 100g Fw(7). Blueberries were first popularized as a "super fruit" due mainly to the high in vitro antioxidant capacity of their abundant polyphenolic compound. However, direct antioxidant action of polyphenolic compounds in situ appears unlikely due to their poor bioavailability (8). Antioxidant



chemicals in fruits include not only the substances such as folate and phenolics, and flavonoids, especially anthocyanins, characterized by high antioxidant activity, but also enzymes as SOD, PPO, POD and CAT, etc. hence its worldwide popularity due to its high nutritional value (9) correction analysis between blueberry chemical composition and enzyme activities. (10) The Composition of the phytochemical profiles in blueberries varies widely, according to the cultivar, season, location, harvesting, storage and the degree of maturity at harvest. The development stage of blueberries influence the phytochemical compound and antioxidant activities of blueberry. (11)

● **KINDS OF BLUEBERRY**

There are numerous kinds of blueberries. Some depending on their development (from foremost to rearmost) are the following,

Earlyblue, Bluetta, Spartan, Patriot, Berkeley, Bluecrop, Liberty, Elliot, among others. The cranberry Eventually, a veritably appreciated and veritably little cultivated variety (*Vaccinium vitis-idaea* L.). It's located in the northern semicircle substantially. Its fruits are of a violent red and for that reason it's further special than the common blueberry. (12)

● **DIFFERENCES BETWEEN WILD AND CULTIVATED BLUEBERRIES**

Wild blueberries first appeared after the glaciers retreated after the last ice age. Spring forward 10,000 years to 1911 New Jersey where farmer Elizabeth White teamed up with botanist Fredrick Colville to see if they could do what many considered impossible. They wanted to domesticate the wild blueberry. Wild blueberries are not planted, they are managed. This means that the blueberry barrens are places where berries grew naturally. Wild blueberries spread by growing runners underground. What may look like a group of plants is actually one plant that has spread out its root systems. This is a fairly slow process and it can take years before a field is ready for production.

Cultivated berries are designed for a certain taste. While there may be over 29 varieties of cultivated berries, each variety has been designed for a unique taste. The wild blueberry follows no design. Almost each berry will have a different level of sweet or tart and allows for overall richer taste experience. Since the wild berry has less water, it is a more favourable berry.

● **BIOACTIVE COMPOSITES OF BLUEBERRIES POST HARVEST FACTORS IMPACTING NUTRITIONAL VALUE OF PRODUCT**

A growing quantum of blueberries undergoes processing, the operation of post-harvest running styles towards conservation of nutritive quality and food security feel to be important factors for consumers and the assiduity. therefore, the end of this review is to present the development of technologies and styles used for blueberry post-harvest processing, especially drying, with the attention concentrated on the parameters defining the bioactive parcels of products.

● **MAIN GROWING REASONS**

According to the FAO [21] and the United States Department of Agriculture (USDA), the United States is the largest blueberry-producing country, with an average production of over 200 thousand tons (2009–2013) accounting for over half of the global production. In the USA, blueberry is grown in almost all states, but about 70% of total production comes from Maine, Michigan, New Jersey, Oregon and Georgia [22]. The north-south distribution of production centre allows the prolongation of the harvest period and, consequently, the continuous supply of fresh fruit from the middle of April–October

[23]. In Europe, blueberry is grown in almost all EU member countries (68 thousand tons) and in some Eastern European countries (28 thousand tons) [24]. At present, blueberries are produced on all continents. According to the USA Department of Agriculture (USDA), over 50 blueberry cultivars currently used for production. They differ in many agronomic features, the most important of them being the harvest date, frost resistance and the required number of chilling hours. Bluecrop, a medium-maturing cultivar with a high yield, is the most popular cultivar in the world (50% of plantings worldwide) [25]. Other popular cultivars include Berkeley, Duke, Elliott, Spartan, Nelson, Herbert and Darrow. Besides their agronomical value, blueberry cultivars are diverse in term of chemical composition and nutritional value. Moreover, the same cultivar can vary in chemical composition and nutritional value depending on where it is grown [26].

● **HARVEST AND MANAGEMENT OF FRUIT CROP**

The berry yield per bush is between 8 and 12 kg, which requires up to ten pickings by hand during the



harvest season. However, in countries with high labor costs, blueberries are first picked manually 3–5-times, and after a several-day interval, the rest of the fruit is collected by a fruit harvester. Blueberries picked by hand are packaged in plastic transparent boxes and sold for fresh consumption. After being harvested, regardless of the picking method, blueberries are immediately sorted and placed in cold storage (for either long storage or processing by hydrocooling technology with the addition of sodium hypochlorite solution) at the optimum storage temperature of 0 °C [27] to reduce respiration and fruit dehydration.

● FRUIT STRUCTURE

A single layer of epidermis without stomates [29] that is covered by a hydrophobic surface of cuticle and epicuticular wax (Figure 1). This unique part of the fruit plays a valuable role as a protective buffer against external factors (desiccation, infections by pathogenic bacteria and insects, the influence of weather conditions). On the other hand, the waxy outer layer also controls the uptake of water and chemical substances into the fruit, a crucial factor in dewatering/drying processes. Thus, the epicuticular waxy layer not only acts as a significant physiological agent, but also affects it.

Figure-1 structure of blueberries



● PROPERTIES OF BLUEBERRY ARE

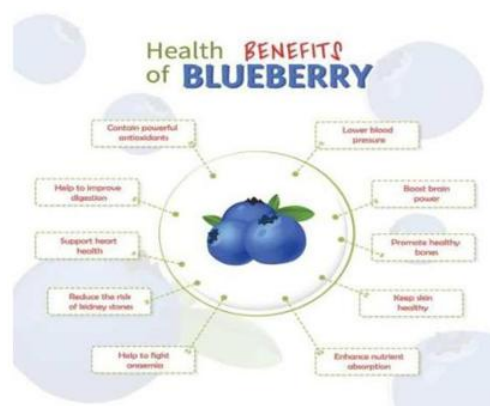
- [1] It may act as an antioxidant
- [2] .It may have body weight maintaining ability.
- [3] It may have anti-cancer activity
- [4] .It may have a blood sugar-lowering effect.
- [5] It may have a blood pressure maintaining activity.
- [6] It may have a cholesterol-lowering effect.
- [7] It may have antibacterial activity.
- [8] It may have anti-inflammatory action.
- [9] It may benefit liver health.
- [10] It may have immunity enhancing effect.
- [11] It may benefit brain health.

● CHEMICALS AND REAGENTS

Catechin, Folin- Ciocalteu reagent, 2,2-diphenyl-1-picrylhydrazyl (DPPH), 2-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) diammonium swab (ABTS), and all the 21 phenolic norms used in high performance liquid chromatography (HPLC) analysis were bought from Sigma-Aldrich (St. Louis, MO, USA). Trolox (6-hydroxy acid) was attained from Acros Organics (Morris Plains, New Jersey, USA). Gallic acid was bought from J&K Chemical Ltd. (Beijing, China), and rutin from Sinopharm Chemical Reagent Co., Ltd. (Shanghai, China). Other chemicals and reagents used in this study were of logical grade and were attained from China.

● HEALTH BENEFITS

Blueberries contain vitamins, minerals, and antioxidants that give notable health benefits. For illustration, blueberries are rich in vitamin K, which plays an important part in promoting heart health. The vitamin is also important to bone health and blood clotting. Other health benefits of blueberries include Advanced antioxidant situations Blueberries are one of the stylish natural sources of antioxidants. While antioxidants are not necessary for your body to serve, they help cover your body from damage by free revolutionaries. Your cells produce free revolutionaries as waste products, but these patches can go on to hurt other cells. Eating blueberries regularly for just two weeks can help reduce damage to your cells by as important as 20. More cholesterol situations.



[Fig-2] Diagrammatic Representation of Health Benefits of Blueberry

Antioxidant exertion vaticination by NIR Spectroscopy- The antioxidant exertion by means of the TPC, TFC and TAC was estimated through the air dried leaves near infrared gamuts for the



preliminarily defined six data sets considering each data set independent. The NIR fashion is known as a point " fashion since it captures the chemical information related with the hydrogen snippet, videlicet C- H, O- H, N- H and S- H bonds, present on the samples. In this sense, the being chemical composites in Vaccinium cultivar leaves that retain antioxidant capacity contribute to NIR spectra. The numbers of merit attained from the stylish partial least places (PLS) models were presented. Antioxidant exertion Air-dried mulled Vaccinium leaves(50 mg) were uprooted in 20 mL of an ethanolic/ water(50/50, v/ v) result for 240 min in an orbital shaker at 300 rpm. The birth time was Antioxidant exertion vaticination by NIR Spectroscopy- The antioxidant exertion by means of the TPC, TFC and TAC was estimated through the air dried leaves near infrared gamuts for the preliminarily defined six data sets considering each data set independent. The NIR fashion is known as a point " fashion since it captures the chemical information related with the hydrogen snippet, videlicet C- H, O- H, N- H and S- H bonds, present on the samples. In this sense, the being chemical composites in Vaccinium cultivar leaves that retain antioxidant capacity contribute to NIR spectra. The numbers of merit attained from the stylish partial least places (PLS) models were presented. Antioxidant exertion Air- dried mulled Vaccinium leaves(50 mg) were uprooted in 20 mL of an ethanolic/ water(50/50, v/ v) result for 240 min in an orbital shaker at 300 rpm. The birth time was named by the dimension of the quantum of uprooted phenolics(TPC system) after 60, 120, 180, 240, and 300 min. The birth yield after 240 min wasn't statistically different ($p>0.05$) from those determined at longer birth times. Excerpts were attained in duplicate in two distinct days. Total Phenolic Content (TPC) Folin- Ciocalteu assay was performed in a 96- well microplate as described in Magalhães et al (16). Compactly, 150 μ L of adulterated excerpts (150), 50 μ L of Folin- Ciocalteu reagent (310, v/ v) and 100 μ L of carbonate buffer result(9(w/ v) were successively added to each well. The reduction atalkaline pH of the Folin- Ciocalteu reagent by leaves phenolics was covered at 760 mM during 120 min. Gallic acid standard results were used for estimation. Total flavonoid Content (TFC) The total flavonoid content (TFC) of the adulterated hydroalcoholic excerpts (110) was determined through their absorbance at 510 mM(15). In a 96- well plate, 75 μ L of the adulterated excerpt and 75 μ L of a NaNO_2 (6 g \cdot L⁻¹ result were placed in each well. Total Antiox idant Capacity(TAC) The total antioxidant capacity(

TAC) was measured by means of the absorbance drop at 734 mM of the adulterated hydroalcoholic excerpt(150) due to the reduction of the ABTS -radical.The natural immersion of samples was estimated by replacing the ABTS \cdot radical result with water. Trolox standard results were used for estimation. The TAC of the excerpts was expressed as mM of Trolox per g of dry splint and each excerpt was adulterated with 80 ethanol to an absorbance of 0.700 ± 0.005 at 734 nm. The tested sample was adulterated with 80 ethanol so as to give 20 – 80 inhibition of the blank absorbance with 0.1 ml of sample. A aggregate of 3.9 ml of ABTS \cdot result was added to 0.1 ml of the tested samples and mixed completely. The reactive admixture was allowed to stand at room temperature for 6 min and the absorbance at 734 nm was also recorded incontinently. Different situations (0.1,0.2,0.4,0.6,0.8, and 1.0 mmol/ L) of Trolox standard result in 80 ethanol were prepared and assayed under the same conditions. Results were expressed in terms of Trolox original antioxidant capacity (TEAC), i.e., mmol Trolox/ 100 g dry weight(DW).

Implicit usages of Blueberry-

- 1) Implicit usages of blueberry for race sugar. Blueberries are rich in anthocyanin, which may have antioxidant exertion. It might be salutary in reducing the oxidative pressure and might play a pivotal part in race sugar operation — An boost in race sugar situations are characterised by a penurious reaction to insulin stimulation. The anthocyanin- rich blueberry might drop glucose dogmatism. In across-sectional study involving women conducted by Jennings et al. 2014, showed off that advanced consumption of blueberries results in advancements in insulin defiance. therefore, it may be salutary for managing race sugar situations in humans. still, this study is inadequate. thus, there's a want for further inquiries to develop the positive sequel of blueberries on race sugar operation.
- 2) Implicit usages of blueberry for cancer Blueberry might be helpful in reducing the spread and enhancing the death of cancer cells. It might also minimize chances of cancer evolution and the threat of rush of cancer. But the factual medium is unknown. A laboratory study (Minker C et al. 2015) showed off that lowbush type blueberry is formulated of proanthocyanidins(antioxidant) which may have the capability to kill cancer cells in mortal colon cancer cell lines; therefore, it might be an essential anti-cancer agent for colon cancer. tallying to an beast model study by Lin W et al.,



2017, blueberry consumption might drop tumour size and inhibit ovarian cancer cells by regulating situations of some enzymes. This information is inadequate as these inquiries are done in laboratories and not on humans. thus, further inquiries on humans are needed to back this claim. Accordingly, we advise you to verbalize to your concerned croakers and only have blueberries as a drug.

3) Implicit usages of blueberry for brain health Blueberry has an antioxidant exertion which might support to reduce oxidative pressure caused due to free reactive oxygen species in the brain. The diurnal consumption of blueberry juice might be salutary for degenerative conditions. It might profit in proper race inflow to the brain in healthy aged grown-ups. It might also enhance mind an lag the debilitation of the brain cells. US cohort inquiries on humans conducted by Gao, showed off a lesser threat of Parkinson's complaint upon input of blueberry. Cognitive thinking, logic and remembering) interpretation in the other grown-ups and the senior were observed to have bettered after input of blueberry greasepaint. still, we bear further inquiries to support the salutary sequel of blueberries on maintaining brain health. This information is inadequate and it's necessary to take a croaker's guidance before utilizing blueberries.

4) Implicit usages of blueberry for the eyes Blueberries may enhance unreality. thus, the consumption of blueberries may have some sequel to recover visual nippiness. Anthocyanins in blueberry might contribute to eye health and reduce retinal retina is a portion of the eye) conditions. Blueberry might guard the retina from light-convicted injury. This information is inadequate. thus, farther exploration is demanded to enunciate that blueberries might profit eye health.

Other Implicit Uses of Blueberries -

1) Blueberries are used as a functional food. It may have parcels to manage inflammation- related problems.

2) Blueberry may also have modest benefits in the memory performance. 2) Side goods of Blueberries The side goods associated with blueberry are

3) No major study reports the side goods of blueberry.

4) still, the frequence of blueberry antipathetic responses may be observed. Children may develop symptoms similar as briefness of breath and aft itching after ingestion of blueberry fruit. A croaker should be incontinently consulted to help any health issues during similar antipathetic responses.

5) Blueberry fruit or its leaves might lower the blood pressure as well as they might drop blood sugar situations below normal. still, if you witness any side goods, seek immediate medical attention from your croaker, who have specified it to you. They will be the stylish companion to give you with proper treatment.

PRECAUTIONS TO TAKE WITH BLUEBERRIES

The following precautions should be taken while consuming blueberries: 1) There is no sufficient information currently available to consider the safe use of blueberries for pregnant and breastfeeding women. But, safety during pregnancy and breastfeeding is necessary, so a doctor's advice is always recommended. 2) Glucose-6-phosphate dehydrogenase deficiency is a genetic disorder. People with this disorder must consult a doctor before consuming blueberry to stay safe and prevent health disorders. 3) People who have undergone surgery should take precautions because blueberry consumption might affect their blood sugar levels. Always go with your doctor's advice and take only the prescribed diet given to you during these times. 4) Allergic reactions might develop in children; hence extra precaution should be taken when giving blueberries to young children. Children require special attention. So if any issues develop, consult a doctor.

5) Without consulting a doctor, people should not use blueberries to self- medicate themselves.

3) Interactions With

Other Drugs 1) Blueberry juice might interfere with certain enzymes, which help to metabolise warfarin (anticoagulant drug). Thus, blueberry juice may lead to an increased risk of bleeding. 2) Any diet modification should be consulted first with your doctor to prevent adverse drug reactions. Doctors will be the best person to direct you on the better way to have blueberries as a hurb.

II. CONCLUSION

Blueberry breeding programs have been targeted to enhance the commercial traits of blueberries, such as size, color, firmness and productivity. Currently, researchers' attention has been extended to improving the nutritional aspects and, at the same time, to decreasing the negative consequences of processing conditions that are crucial for the quality of final blueberry products. It was shown that every single step of blueberry processing affects the molecular changes in terms of quantity and quality of biologically-active



compounds present in the fruit; however, their exact fate caused by a single process is still unknown. The probability of the increase/degradation is assumed to be different for each particular biologically-active compound

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