



Review Article

Health Promoting Properties and Extraction of Specific Bioactive Compounds in Blueberries

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ABSTRACT

In addition to possessing well-known flavor attributes, blueberries are an exceptional source of health-promoting bioactive compounds. Blueberries have been developing in ubiquity over the world for decades. Blueberries are high in flavonoids (for the most part anthocyanidins), polyphenols (procyanidin), phenolic acids, pyruvic acid, chlorogenic acid, and other compounds that have anticancer, anti-obesity, anti-inflammation, defensive properties for vision and liver, avoid heart maladies, anti-diabetes, boost brain work, muscular bones, improve insusceptibility, anticipate cardiovascular maladies, and boost cognitive decay. Blueberry extraction procedures have progressed essentially in later a long time. Modern extraction technologies include Ultrasound-Assisted Extraction, Microwave Assisted Extraction, Pulsed Electric Field Extraction, and Supercritical Liquid extraction. This strategy strikes a stability between the fruit's dietary value and its occurrence. This improvement within the food division is due to customer expectations that are getting to be more health-conscious, prompting the industry to look for ways to dodge ailment.

INTRODUCTION

Different epidemiological surveys conducted in a range of countries appear that are diet wealthy in fruits and vegetables, counting fruit and vegetable items, decreases the chance of a variety of ways of infections, including cardiovascular illness and cancer, as well as other disorders such as rheumatoid joint pain, lung infection, cataract, Parkinson's disease, and Alzheimer's illness [1]. Blueberries are now widely acknowledged as one of the most important healthy food. The geographical region where high bush blueberries are cultivated has drastically expanded over the last 100 years, into hot and arid climates [2]. Blueberries (*Vaccinium* spp.) are a member of the Ericaceae family, which comprises over 450 different

species. Blueberries, like cranberries and lingonberries, were cultivated in the 20th century. Blueberries have risen in importance during the early 1990s. Blueberries were only commercially planted in ten nations in 1990, but in 2011, they were farmed in 27 nations [3]. Blueberry fruit includes dietary fiber, vitamins, protein, and nutritious elements that seems to be excellent for well beings, such as immunomodulatory compounds, tannic acid, folic acid, antimicrobial components, and antioxidants, in addition to being pleasant and flavorful. Bioactive substances and response modulators abound in blueberries [4]. Blueberries contain therapeutic properties and are good for human well-being [5]. The massive concentration of

phytochemicals classified as polyphenols within blueberries has sparked renewed focus on their effects on health. Several epidemiological researches elaborate that the blueberries' elevated polyphenol component, notably a subcategory designated as anthocyanins, is to blame for their numerous advantages to health. Blueberries have recently gained popularity since they are abundantly rich in micronutrients, fiber, as well as polyphenols while being little in calories [6]. Blueberries too have an elevated concentration of phytochemicals such as ascorbic acid as well as phenolics. The bioactive qualities of the phytochemical components are associated with a few of the indicated favorable results of health-associated blueberry intake. Ascorbic corrosive, flavonols (counting kaempferol, quercetin, and myricetin), hydroxycinnamic acids (counting caffeic acids, ferulic acids, and coumaric acids), hydroxybenzoic acids (counting gallic acids and protocatechuic acids), pterostilbene, resveratrol is the foremost common bioactive constituent found in blueberries [7]. Chemical composition of blueberries is presented in table 1.

Nutrients in blueberries	Nutrients Amount per 100 g fresh weight (Fresh)	Nutrients Amount (Fresh)	Nutrients Amount (Frozen) unit/50 g.	Nutrients Amount of 1 cup of fresh blueberry
Energy	57 kcal	192 kJ	174.0 kcal	84 calories
Carbohydrate	14.5 g	9.7%	42.3 g	21.45 g
Water	-	84%	-	-
Fat	0.33 g	0.4%	-	0.49 g
Protein	0.74 g	0.6%	1.7 g	1.1 g
Dietary fiber	2.4 g	3-3.5%	93 g	3.6 g
Potassium	77 mg	-	204mg	114 mg
Fructose	4.97 g	-	-	-
Total beta carotene	31 µg	-	-	-
Vitamin C	9.7 mg	10 mg	86.0 mg	24%
Calcium	6 mg	-	15.0 mg	9 mg
Iron	0.28 mg	-	0.5 mg	-
Vitamin E	0.57 mg	-	-	-
Vitamin B1	0.04 mg	-	-	-
Vitamin B2	0.04 mg	-	-	-
Vitamin B6	0.05 mg	-	-	5%
Phosphorus	12 mg	-	-	18 mg
Sodium	-	-	8.0 mg	1 mg
Magnesium	6 mg	-	-	9 mg
Zinc	0.16 mg	-	-	0.24mg
Manganese	0.336 mg	-	-	-
Niacin	0.418 mg	-	-	-
		Michalska and Łysiak 2015 [3]	Basu et al., 2010 [8]	Ware 2017 [9]

Table 1: Chemical composition of blueberries

Bioactive constituents in blueberries

Phenolic compounds in blueberries: Throughout the last

15 years, the area of polyphenols and health has exploded. Polyphenols are antioxidant-active chemicals, which sparked a lot of recent interest in learning more about one's possible health advantages for individuals. Phenolic chemicals have also been demonstrated to have anti-inflammatory and cellular signalling properties, focusing attention on a variety of disease danger zones such as cardiovascular health, neuroprotection, and metabolic health [10]. Numerous meals contain organic phenolic constituents, including vegetables, fruits, tea, coffee, chocolate, wine, honey and oil [11]. Polyphenols are extensive groups of chemicals that are only formed in plants. Flavonoids, phenolic acids, stilbenes, lignans, and tannins are the primary groupings. Research has demonstrated that drinking polyphenol-rich blueberry or grape juice on a regular basis for 12 weeks improves episodic learning capacity in older folk [12] and also polyphenolic constituents in blueberries also demonstrated substantial and repeatable anti-aging advantages which have been distinct from antioxidant activities [13]. Diets high in phenolic constituents have been linked to a reduced likelihood of a variety of chronic illnesses, especially cancer [14]. Stilbenoids, tannins [hydrolyzable tannins (gallotannins and ellagitannins) and condensed tannins (proanthocyanidins) and flavonoids, including flavan-3-ols, and their polymeric condensation products, flavanones, flavonols (i.e., kaempferol, quercetin, myricetin), and flavones, are among the phenol Blueberries contain a lot of phenolics, which contribute for 50–80% of the total polyphenol content, which might also exceed up to 3000 mg/kg fresh and dry weight [15].

Anthocyanin in blueberries: Anthocyanins are glycosides of anthocyanidins, and they are the foremost critical category of water-soluble tints in plants. Indeed, on the off chance that more than 550 anthocyanins have in fact been distinguished, as it were just few anthocyanidins are display in lofty plants, and they are generally found in blossoms, pulps, and fruit peels (especially in berries)[16]. Anthocyanins are bioactive flavonoid molecules that are compelling in the treatment of a variety of chronic disorders. These are generally ingested within the kind of meals originating through plant sources, with blueberry being one of the fruits that's well-known for its enhanced and anthocyanin substance. It's one of the natural products with a part of anthocyanins and other polyphenolics, which have appeared to have antioxidant impacts [17]. Several of the primary flavonoid groups are anthocyanins, which seem to be natural pigments that give fruits their blue, purple, violet, and red tints[18-20].

CONCLUSIONS

Blueberry anthocyanidins and polyphenols have

nutraceutical properties against chronic sicknesses.

REFERENCES

- [1] Yin X, Quan J and Kanazawa T. Banana prevents plasma oxidative stress in healthy individuals. *Plant foods for human nutrition*. 2008;63(2):71-76. doi: 10.1007/s11130-008-0072-1.
- [2] Lobos GA and Hancock JF. Breeding blueberries for a changing global environment: a review. *Frontiers in plant science*. 2015;6:782. doi:10.3389/fpls.2015.00782.
- [3] Michalska A and Łysiak G. Bioactive compounds of blueberries: post-harvest factors influencing the nutritional value of products. *International journal of molecular sciences*. 2015;16(8):18642-63. doi:10.3390/ijms160818642.
- [4] Chan Ho PA, Yi Sub KW, Han Kyo SE and Hye Young KI. Assessing the values of blueberries intake on exercise performance, TAS, and inflammatory factors. *Iranian journal of public health*. 2018;47(Suppl1):27.
- [5] Kalt W and Dufour D. Health functionality of blueberries. *HortTechnology*. 1997;7(3):216-221. doi:10.21273/HORTTECH.7.3.216.
- [6] Wood E, Hein S, Heiss C, Williams C and Rodriguez-Mateos A. Blueberries and cardiovascular disease prevention. *Food & function*. 2019;10(12):7621-33. doi:10.1039/C9FO02291K.
- [7] Koupý D, Kotolová H and Kučerová J. Effectiveness of phytotherapy in supportive treatment of type 2 diabetes mellitus. *Ceska a Slovenska farmacie: casopis Ceske farmaceuticke spolecnosti a Slovenske farmaceuticke spolecnosti*. 2015;64(1-2):3-6.
- [8] Basu A, Du M, Leyva MJ, Sanchez K, Betts NM and Wu M et al. Blueberries decrease cardiovascular risk factors in obese men and women with metabolic syndrome. *The Journal of nutrition*. 2010;140(9):1582-7. doi:10.3945/jn.110.124701.
- [9] Ware M. Everything you need to know about blueberries. *Medical News Today*. 2017;30:2019.
- [10] Zhong S, Sandhu A, Edirisinghe I and Burton-Freeman B. Characterization of wild blueberry polyphenols bioavailability and kinetic profile in plasma over 24-h period in human subjects. *Molecular nutrition & food research*. 2017;61(12):1-13. doi: 10.1002/mnfr.201700405.
- [11] Olas B. Berry phenolic antioxidants—implications for human health? *Frontiers in pharmacology*. 2018;9(3):1-14. doi:10.3389/fphar.2018.00078.
- [12] Bensalem J, Dudonné S, Gaudout D, Servant L, Calon F and Desjardins Y et al. Polyphenol-rich extract from grape and blueberry attenuates cognitive decline and improves neuronal function in aged mice. *Journal of nutritional science*. 2018;7(19):1-10. doi: 10.1017/jns.2018.10.
- [13] Wilson MA, Shukitt-Hale B, Kalt W, Ingram DK, Joseph JA and Wolkow CA. Blueberry polyphenols increase lifespan and thermotolerance in *Caenorhabditis elegans*. *Aging cell*. 2006;5(1):59-68. doi: 10.1111/j.1474-9726.2006.00192.x.
- [14] Yi W, Fischer J, Krewer G and Akoh CC. Phenolic compounds from blueberries can inhibit colon cancer cell proliferation and induce apoptosis. *Journal of agricultural and food chemistry*. 2005;53(18):7320-7329. doi:10.1021/jf051333o.
- [15] Müller D, Schantz M and Richling E. High performance liquid chromatography analysis of anthocyanins in bilberries (*Vaccinium myrtillus* L.), blueberries (*Vaccinium corymbosum* L.), and corresponding juices. *Journal of Food Science*. 2012;77(4):C340-5. doi.org/10.1111/j.1750-3841.2011.02605.x.
- [16] You Q, Wang B, Chen F, Huang Z, Wang X and Luo PG. Comparison of anthocyanins and phenolics in organically and conventionally grown blueberries in selected cultivars. *Food Chemistry*. 2011;125(1):201-208. doi: 10.1016/j.foodchem.2010.08.063.
- [17] Routray W and Orsat V. Blueberries and their anthocyanins: factors affecting biosynthesis and properties. *Comprehensive Reviews in Food Science and Food Safety*. 2011;10(6):303-320. doi: 10.1111/j.1541-4337.2011.00164.x.
- [18] Lohachoompol V, Srzednicki G and Craske J. The change of total anthocyanins in blueberries and their antioxidant effect after drying and freezing. *Journal of Biomedicine and Biotechnology*. 2004;2004(5): 248-252.
- [19] Phan K, Van Den Broeck E, Van Speybroeck V, De Clerck K, Raes K and De Meester S. The potential of anthocyanins from blueberries as a natural dye for cotton: A combined experimental and theoretical study. *Dyes and Pigments*. 2020;176(2):1-43. doi: 10.1016/j.dyepig.2019.108180.
- [20] Fang J. Bioavailability of anthocyanins. *Drug metabolism reviews*. 2014;46(4):508-20. doi: 10.3109/03602532.2014.978080.