

# WHITE PAPER

## IRONBERRY (Natures Goodness)

*Presents:*

*Wild Blueberry Powder*

*Directly From Newfoundland Canada*

*White Paper Research Authors:*



**The Mortec Scientific Group**

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### **Abstract**

This paper opens by distinguishing between wild and regular blueberries, with the former outperforming the latter on various measures. For example, wild blueberries contain more nutrients and thus yield more potent health benefits. Next, attention will be given to Iron Berry, a company who produces superlative wild blueberry products. Finally, the benefits correlated with wild blueberry intake will be explored. It is important to note, however, that the benefits afforded by wild blueberries are vast and are therefore beyond the scope of this discourse. Nonetheless, some commonly cited benefits include optimal cardiovascular health and cancer prevention.

**The Unprecedented Effects of Blueberries**

**In Newfoundland**

Many of the blueberries found in grocery stores west of Quebec tend to be cultivated high bush blueberries, which are planted specifically for harvesting. These blueberries are larger compared to the low bush wild blueberries that grow naturally in the East Coast (see Image 1). While the latter tend to have a sweeter taste than their cultivated counterparts, they also afford greater health benefits (Walther, 2018).

Image 1: Wild (Left) Versus Regular (Right) Blueberries



*Note:* Image retrieved from Davis (2018)

Iron Berry, based in Newfoundland, produces various blueberry products derived from superlative and stringent processes. Consequently, consumers are encouraged to purchase these products to augment the health benefits afforded by blueberries, which include enhanced cognition and diabetes prevention, with additional benefits explored and elaborated on throughout this discourse.

### **About Iron Berry**

Quality standards are of utmost importance to Iron Berry, who devote themselves to producing quality products as well as accomplishing the greater good. They assert, “With great courage, integrity and love – we embrace our responsibility to co-create a world where each of us, our communities and our planet can flourish. All the while, celebrating the sheer love and joy of food” (Iron Berry, 2017). Iron Berry’s mission is to offer minimally processed, natural and flavourful foods, and pride themselves on fostering a respectful work environment. The Iron Berry vision of a sustainable future revolves around the principles of creativity, diversity, choice, environmentalism, education and accountability. They encourage paradigm shifts to change the way people think about the relationships between food supply, the environment and our bodies.

Iron Berry is run by a passionate and educated team. For instance, Marek Krol, president and owner, graduated from agricultural school with a specialization in wild herbs, and natural and organic foods. In 2009, he began purchasing properties in Newfoundland to develop agriculture and organic products. Marek and his dedicated team continue to pioneer the organic movement today.

Iron Berry’s products are derived from locally produced berries (blueberries, cranberries and sea buckthorn), many of them growing wild, pesticide and chemical-free on the island of Newfoundland. The water used in their berry supplements process is drawn from their artesian well and has been tested for purity: “It’s quality is second to none” (Iron Berry, 2017). Additionally, their powders and capsules are made locally in Markland. Ultimately, through diligence, their processes have been developed and refined throughout the years to enhance the quality and benefits afforded by their products. For example, they use the whole berry in making their products.

Iron Berry’s products are manufactured and packaged under a site license granted by Health Canada under the National Health Products Regulations. These licences are obtained by demonstrating that manufacturing, importing, labelling, packaging, distribution and/or storing practices adhere to the requirements of the Canadian Good Manufacturing Practices (GMPs) for Natural Health Products.



Under such a site license, “All Manufacturers, Producers, Labellers and importers of Natural Health Products are responsible for ensuring that their Quality Assurance Persons and Third Party Auditors are qualified under Sections 47 and 51 of the Natural health Products Regulations.” The former states, “Every natural health product shall be manufactured, packaged, labelled and stored by personnel who are qualified by education, training or experience to perform their respective tasks.” The latter mandates, “1. Every manufacturer, packager, labelled, importer and distributor shall have a quality assurance person who: is responsible for assuring the quality of the natural health product before it is made available for sale, and has the training, experience and technical knowledge relating to the activity conducted and the requirements of this part; 2. Investigate and record every complaint received in respect of the quality of the natural health product and, if necessary, take corrective action” (Iron Berry, 2017).

Iron Berry’s products are certified Kosher and are made in a certified Kosher facility for religious and health reasons; this certification carries strict laws governing all processes utilized in the processing of a consumable product.

Chia seeds are harvested from a purple and white flowering plant called *Salvia hispanica* L. Since optimal growing conditions are in regions close to the equator, Iron Berry has developed a long-term relationship with a supplier in South America. Iron Berry (2017) states, “The way that our chia is grown remains true to our core mission of uplifting the soul of humanity and the soul of the planet! All of our products are USDA Certified Organic, meaning they are produced without the use of toxic pesticides and fertilizers, antibiotics, synthetic hormones or GMOs. By supporting farmers that use organic farming methods, we prevent disruption of our delicate and vital ecosystem by reducing the amount of chemicals released into the environment.” Iron Berry nutritionally analyzes each batch of seeds to ensure that they adhere to their strict nutritional criteria.

Iron Berry produces various products: ground chia seeds, the ultimate smoothie mix, whole chia seeds, wild blueberry powder, cranberry powder, seabuckthorn powder, chia seed wild blueberry powder, chia seed cranberry powder, chia seed seabuckthorn powder and chia seed berries powder mix (Iron Berry, 2017). See below images for some of Iron Berry’s blueberry products.

Image 2: Iron Berry's Chia Seed Berries Powder Mix

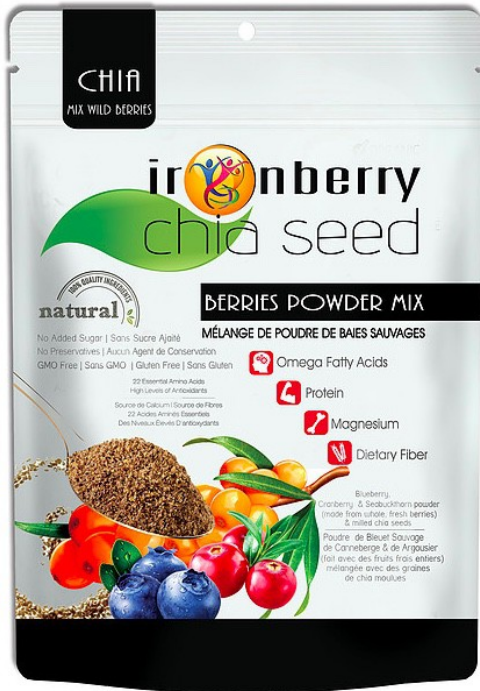


Image 3: Iron Berry's Chia Seed Wild Blueberry Powder



Image 4: Iron Berry's Ground Chia Seeds The Ultimate Smoothie Mix

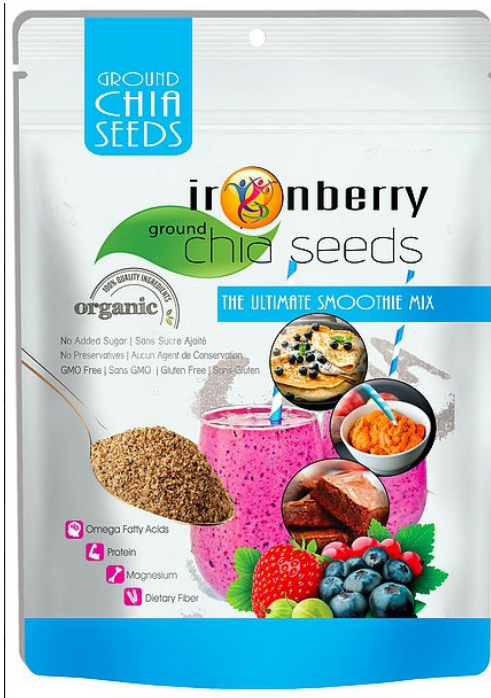
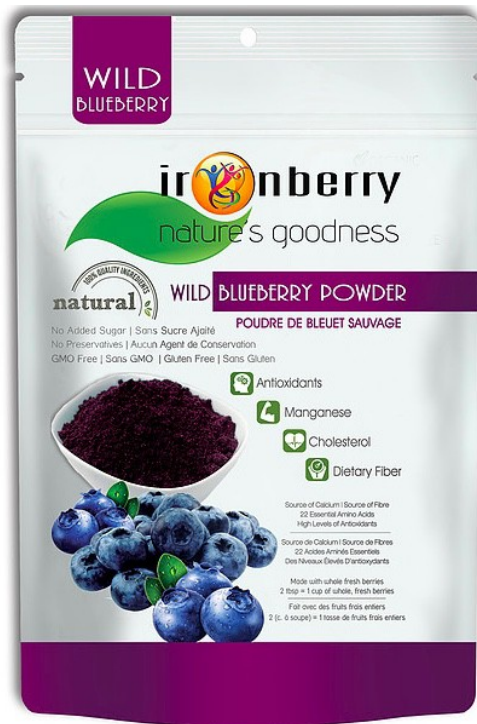


Image 5: Iron Berry's Wild Blueberry Powder



Note: Images retrieved from Iron Berry (2017)

### Benefits Associated With Wild Blueberries

One of merely three (3) berries native to North America, “the low bush wild blueberry was prized by our earliest inhabitants for its taste, nutrition and healing qualities” (Iron Berry, 2017). Many contemporary studies support these early contentions. It is noted, “Wild blueberries and other flavonoid-rich berries are the subject of promising health research in many different areas including: antioxidant activity, brain research, cancer prevention, gut health, heart health, metabolic syndrome, diabetes prevention, urinary tract health” (Iron Berry, 2017). They are rich in a plethora of nutrients, including vitamin C, vitamin K, vitamin B6, folate, potassium, copper and manganese. Further, they are low in calories, carbohydrates and sodium, and are high in water content. Additional nutrients will be explored later in this discourse (OrganicFacts, 2018).

Abundant in antioxidants, wild blueberries have grown naturally in the fields and barrens of Maine and Canada for thousands of years. They contain more total antioxidant capacity (ORAC) compared to most fruits and vegetables; United States Department of Agriculture scientists have shown that blueberries contain the highest antioxidant capacity of forty (40) fruits and vegetables tested (Health Corner, n.d.; Prior et. al, 1998). Panda (2017) asserts, “A cup of wild blueberries has up to 13, 427 antioxidants...” A study in the *British Journal of Nutrition* found that supplementing participants with wild blueberry powder increased serum antioxidant status by 8.5% after merely one (1) hour (Link, 2018). The antioxidant compounds in blueberries are contained in their deep-blue pigments; these anthocyanins, a subclass of phytonutrients called flavonoids, are known for their potent antioxidant and anti-inflammatory properties. Refer to Images 6 and 7 below.

Image 6: Total Antioxidant Capacity of Wild Blueberries

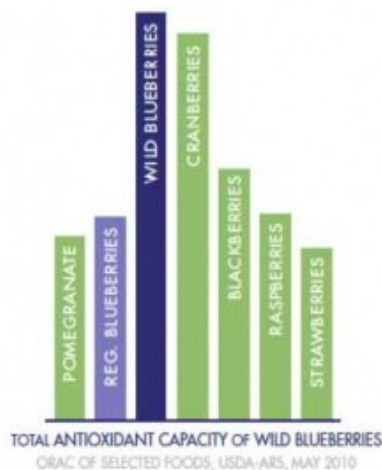
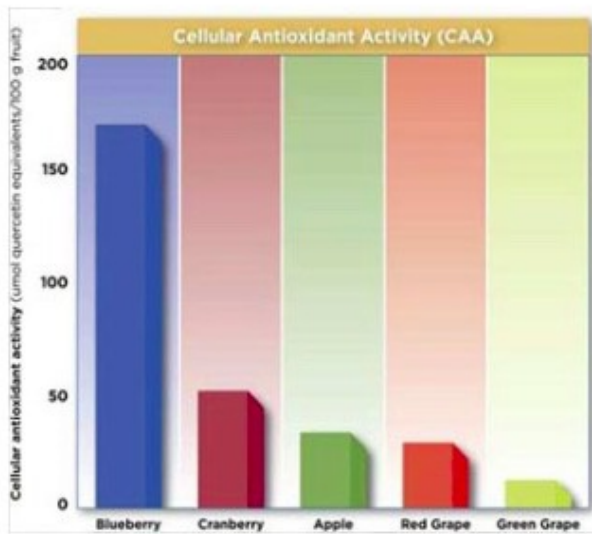




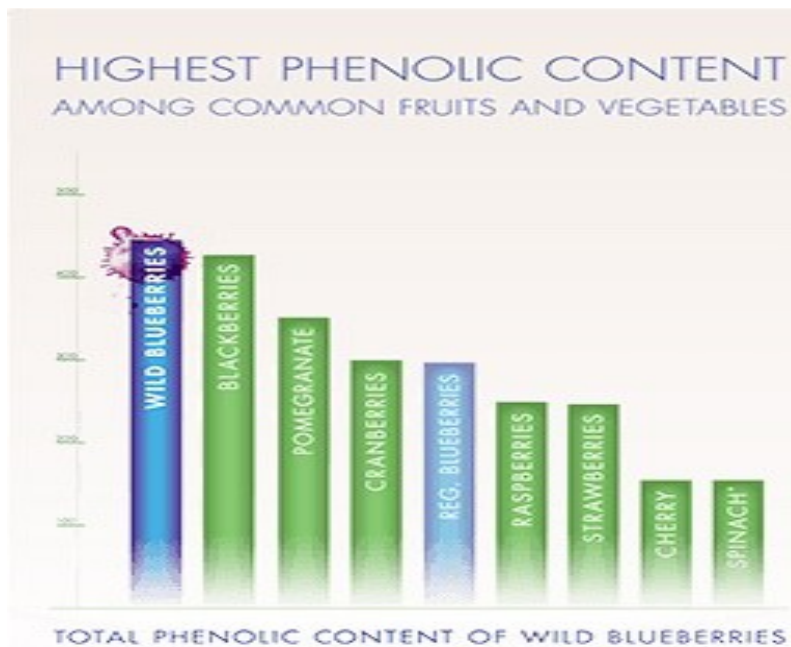
Image 7: Cellular Antioxidant Activity of Blueberries



Note: Image retrieved from Davis (2018)

Blueberries also contain greater concentrations of certain antioxidants, including phenols (see Image 8 below)

Image 8: Phenolic Content Among Selected Fruits and Vegetables



Note: Image retrieved from Davis (2018)

Antioxidants help neutralize free radicals that can cause cell damage leading to cancer, heart disease and other age-related conditions (Health Corner, n.d.; Iron Berry). In particular, antioxidants counteract environmental carcinogens, promote cardiovascular health, thwart sun damage to the skin and bolster cognition. For instance, antioxidants protect against Alzheimer's and help recover short-term memory, thereby strengthening the brain (Health Corner, n.d., Jones, 2005).

Production of reactive oxygen species (ROS) and reactive nitrogen species (RNS) are naturally occurring processes, although overproduction may occur during aging and contribute to neurodegenerative diseases, including stroke. The polyphenolic content in fruits and leaves of blueberries growing in Newfoundland, however, may exert neuroprotective effects against glutamate-mediated excitotoxicity believed to contribute to neurodegenerative diseases. For one, cultures treated with blueberry show no cell loss in the presence of glutamate, indicating a protective effect. Moreover, protective effects are correlated with levels of phenolics and antioxidant capacity. Consequently, blueberries can help prevent stroke and TBI, slow brain aging, inhibit the development of neurodegenerative disorders, increase the antioxidant and antinitrosative capacities of the brain, thwart oxidative stress, and so on (Kalindindi, 2014).

Studies conducted by the United States Department of Agriculture (USDA) and University of Illinois indicate that the benefits afforded by wild blueberry consumption are vast and include preventing cancer, memory loss and loss of motor skills. Researchers from Memorial University have identified compounds in blueberries that have the potential to prevent Parkinson's disease. Dr. Brian Staveley, one researcher behind these findings, asserts that blueberries are "super foods" filled with naturally occurring beneficial compounds that have various biological functions to keep cells healthy. He notes that blueberries counteract some effects of Parkinson's disease in flies. For one, the reduced lifespan in flies with Parkinson's can be partially restored simply by supplementing their diet with blueberries.

Additionally, the abnormal eye structure caused by Parkinson's is remedied with blueberry intake. While this study was conducted with fruit flies, blueberries are believed to hold similar promise for humans (CBC Radio Canada, 2014). Staveley and Lipsett (2014) explain:

“Flies expressing *α-synuclein* in their DA neurons fed BBE [blueberry extract] had up to an 8 day, or 15% greater median lifespan than those fed a standard control diet. In addition, BBE improved *α-synuclein*-induced developmental defects in the *Drosophila* eye. Our biometric analyses revealed that individuals fed BBE had less atypical ommatidia as well as an increased number of mechanosensory bristle cells than those fed a control diet. We propose that BBE, rich in naturally occurring antioxidants, promotes the survival of neurons in tissues with increased levels of *α-synuclein* through a protective cell survival mechanism” (p. 3).

A study found that men who consume blueberries as well as other foods rich in flavonoids are forty (40) percent less likely to develop neurological diseases, such as Parkinson's. Further, those who consume berries at least once a week can reduce their risk of developing the disease by a quarter compared to those who seldom do so (Borah, 2018).

Researchers at the University of Reading in England conducted a double-blind research study to examine the effects of flavonoids on cognitive behaviour in children. Subjects were assigned to one (1) of three (3) conditions: large dose of wild blueberry juice, small dose or a placebo. Participants who consumed a high dose of the juice performed better on cognitive tests compared to subjects in other conditions: “The composite scores for all the tasks highlighted a significant difference in the children's cognition results, with the high-strength wild blueberry drink leading to the best performance and the placebo the least effective performance” (Webster, 2015). It is noted that these results are consistent with a 2010 study that measured the effects of wild blueberry juice on memory function in seniors; researchers found that seniors with age-related memory changes made significant cognitive improvements after drinking wild blueberry juice. Blueberries may delay cognitive aging by up to 2.5 years. They may not only prevent the degeneration and death of neurons, but also repair damaged brain cells and neuron tissues to enhance memory (Leech, 2017; OrganicFacts, 2018).

In regards to cancer prevention, a flavonoid present in wild blueberries inhibits a cancer-promoting enzyme. A well-controlled study found the following:

“Our research revealed that PEBP [polyphenol-enriched blueberry preparation] influence cellular signalling cascades of breast CSCs [cancer stem cells], regulating the activity of transcription factors and, consequently, inhibiting tumour growth in vivo by decreasing metastasis and controlling PI3K/AKT, MAPK/ERK, and STAT3 pathways, central nodes in CSC inflammatory signalling. PEBP significantly inhibited cell proliferation of 4T1, MCF-7 and MDA-MB-231. In all cell lines, PEBP reduced mammosphere formation, cell mobility cell migration. In vivo, PEBP significantly reduced tumour development, inhibited the formation of ex vivo mammospheres, and significantly reduced lung metastasis” (Vuong et al., 2016, p.1).

One animal study found that pterostilbene can help prevent colon cancer; the animals in the BBE control group had 57% fewer pre-cancerous lesions in the colon. In vitro studies have similarly found blueberries effective at inhibiting colon cancer cell proliferation and inducing cancer cell apoptosis (HealWithFood, 2018). Researchers at the University of Illinois tested a variety of berries, concluding that wild blueberries exhibit the greatest anti-cancer activities (Health Corner, n.d.). This may be since they are rich in pterostilbene and ellagic acid (OrganicFacts, 2018).

In another study, subjects were instructed to drink blueberry juice. At the end of the study, oxidative DNA damage due to free radicals was reduced by twenty (20) percent. It is noted that these findings have been supported by smaller studies using either fresh or powdered blueberries (Leech, 2017). Research suggests that antioxidants may inhibit tumour growth, decrease inflammation, and help ward off or retard esophageal, breast, lung, mouth, pharynx, stomach, endometrial, pancreatic, prostate and colon cancer (Ware, 2017). For example, a 2010 test-tube study reported that BBE was able to inhibit the growth and spread of breast cancer cells. Likewise, an animal study from the Brown Cancer Centre at the University of Louisville treated rats with breast cancer using blueberry powder and found that it reduced tumour volume by forty (40) percent (Link, 2018).

To elaborate, blueberries have potent anti-inflammatory effects on the body. A 2014 test-tube study found that the polyphenols contained in blueberries help reduce several markers of inflammation. An animal study in the *Journal of Pharmacy and Pharmacology* similarly found that BBE is effective in reducing swelling in rat paws (Link, 2018).

Wild blueberries are an excellent source of manganese, with one cup providing 200% DV of manganese, a trace mineral that plays an imperative role in bone development and various other bodily functions. They are similarly rich in calcium, iron, phosphorous, magnesium, zinc and vitamin K, which helps improve bone health by increasing bone density and elasticity as well as maintaining bone structure. Further, vitamin K improves calcium absorption and reduces calcium loss. Blueberries also help reduce muscle soreness and fatigue that occurs after strenuous activity, and help in muscle regeneration (OrganicFacts, 2018; Ware, 2017).

Anthocyanins, found in abundance in blueberries, have been linked to ocular health, diabetes, improved circulation and a plethora of other benefits (Health Corner, n.d.), while phytonutrients and antioxidants have been correlated with a reduced instance of heart disease, stroke, cancer, cataracts, chronic obstructive lung disease, diverticulosis and high blood pressure (Jones, 2005). In one study, obese participants at a high risk for heart disease noted a 4-6% reduction in blood pressure after consuming 50 grams of blueberries per day for eight weeks. Other studies find similar effects (Leech, 2017). These effects are augmented by the presence of potassium, calcium and magnesium as well as a lack of sodium.

Wild blueberries are a nutrient-rich food, packed with minerals and fibre. Merely one (1) cup of blueberries contains 6.2 grams of dietary fibre, providing 25% of one's recommended daily value (DV). Foods high in fibre may help reduce the risk of cardiovascular disease, obesity and type 2 diabetes. In particular, due to high levels of fibre, anthocyanin, potassium, folate, vitamin B6 and vitamin C, blueberries can help prevent atherosclerosis, heart attacks and strokes. The absence of cholesterol and homocysteine is also beneficial for the heart. In a 2013 study, anthocyanin intake was correlated with a 32% lower risk of myocardial infarction (Leech, 2017). Fibre and anthocyanin reduce cholesterol, improve blood fat and prevent the clogging of arteries, while vitamin B6 and folate prevent blood vessel damage by inhibiting homocysteine build-up. Finally, potassium regulates the optimal functioning of heart muscles (OrganicFacts, 2018).

One study examined the anti-obesity and anti-diabetic effects of biotransformed blueberry juice (BJ) in KKA mice. BJ protects young KKA mice from hyperphagia, reduces weight gain, and thwarts the development of glucose intolerance and diabetes mellitus. Chronic BJ intake in obese and diabetic KKA mice decreases food intake and body weight. The adipokines pathway appears to be involved in these processes since BJ increased adiponectin levels in obese mice (Vuong et al., 2009). Additionally, a work published in the *Public Library of Science* states that eating wild blueberries can diminish the adverse effects of a high-fat diet and has positive effects on blood pressure

and inflammation, markers of obesity, via high levels of potassium, calcium and magnesium. Consequently, they may prevent/ameliorate the effects of various chronic inflammatory diseases, including arthritis and atherosclerosis. It is claimed, “Some scientists believe that the anti-inflammatory powers of anthocyanins may be even stronger than those of aspirin” (HealWithFood, 2018).

Numerous animal studies have confirmed the beneficial effects of blueberries on weight. For example, an animal study published in *PLoS One* found that blueberry juice prevents obesity in mice fed a high-fat diet. An additional study conducted by the Cardiovascular Center and the Michigan Integrative Medicine Program found that blueberry intake was correlated with a reduction in belly fat in obese rats (Link, 2018).

Blueberries have a low glycemic index value and are beneficial for those with insulin irregularities by regulating sugar levels (Borah, 2018). In a study of 32 obese subjects with insulin resistance, a blueberry smoothie caused significant improvements in insulin sensitivity, thus lowering the risk of metabolic syndrome and type 2 diabetes (Leech, 2017). It is asserted, “Wild blueberries reduce chronic inflammation and improve the abnormal lipid profile and gene expression associated with the MetS. By normalizing oxidative, inflammatory response and endothelial function, regular long-term wild blueberry diets may also help improve pathologies associated with the MetS” (Caba, 2013). Additionally, consuming three (3) servings of blueberries per week reduces one’s risk of type 2 diabetes by seven (7) percent (Ware, 2017).

Due to their high fibre and antioxidant content, blueberries help reduce LDL (“bad”) cholesterol and strengthen cardiac muscles (OrganicFacts, 2018). After a study period of eight (8) weeks, blueberries were found to lower LDL oxidation by 27% (Leech, 2017).

Iron Berry produces various chia seed products, some of which deriving from blueberries. Chia seeds are packed with an immense supply of vitality, energy and strength, and are naturally gluten free. Due to their neutral flavour, chia seeds can be incorporated into various meals, snacks and drinks, including salads and smoothies. They are one of the most nutrient-rich foods, containing a plethora of Omega-3s, protein, fibre, calcium, potassium, and so on. A 15 g serving of chia contains 5g of fibre, 3g of protein and 3g Omega 3. Omega-3s are important for maintaining healthy cholesterol levels, while fibre aids in digestion, helps control blood sugar levels and keeps one feeling fuller for longer, thereby encouraging weight loss and reducing snacking. Protein is similarly important since it is required for muscle growth and repair as well as bone health.

In terms of vitamins and minerals, chia seeds are rich in calcium, iron, magnesium, selenium, zinc, folic acid, thiamine, niacin, potassium, manganese, copper and chromium. Finally, chia seeds are correlated with improved memory and concentration, and relief from joint pain (Iron Berry, 2017).

A study conducted by Oregon State University found that pterostilbene, abundantly present in blueberries, can help bolster the immune system by raising the activity of human cathelicidin antimicrobial peptide, a gene involved in innate immune function that has the ability to combat bacterial infection. The flavonoids found in blueberries have potent anti-inflammatory properties, thus reducing one's risk of catching a cough, cold and other maladies (Borah, 2018). These flavonoid-rich wild blueberries also enhance mood.

Blueberries can be helpful in both preventing and treating urinary tract infections; compounds present in blueberries prevent bacteria from attaching to the bladder wall (Health Corner, n.d.). In particular, the anti-UTI properties of blueberries seem to be linked to high concentrations of epicatechin. Consequently, the *E. coli* bacteria responsible for most infections are eliminated through the urine before it can cause an infection (HealWithFood, 2018). Moreover, blueberries promote optimal digestive health and have the potential to thwart digestive diseases (Borah, 2018). The roughage (fibre) present in blueberries prevents constipation, while vitamins, sodium, copper, fructose and other acids improve digestion by stimulating the secretion of gastric and digestive juices to help food move smoothly through the gastrointestinal system. According to works in the *World Journal of Gastroenterology*, dietary fibre is correlated with increased stool frequency in those with constipation. Moreover, blueberry consumption is linked to a decreased instance of IBS and Crohn's disease, and the alleviation of symptoms of ulcerative colitis (such as bleeding and pain) (Link, 2018; OrganicFacts, 2018).

As alluded to earlier, anthocyanin is imperative to preventing oxidative DNA damage, while vitamin C is crucial to building collagen. In addition, blueberries are rich in salicylates, which are able to remove dead skin, open clogged pores and act against bacteria, and antioxidants, which neutralize enzymes that destroy connective tissue and scavenge free radicals. Consequently, it is claimed that blueberries help prevent the development of wrinkles, age spots and acne. Blueberries have a high concentration of fibre; fibre helps expel yeast and fungus from the body in the form of excreta, thus preventing them from being excreted through the skin. Further, blueberries reduce the appearance of varicose veins and spider veins by strengthening blood vessels and repairing broken capillaries. Since they are high in fibre, blueberries also prevent constipation and thus reduce pressure on the veins.

Ultimately, blueberries promote optimal vascular health. The anthocyanins present in blueberries also detoxify heavy metals from the body, including lead, mercury, cadmium and arsenic, prevent bruising and expedite the healing process (HealWithFood, 2018; OrganicFacts, 2018; Panda, 2017).

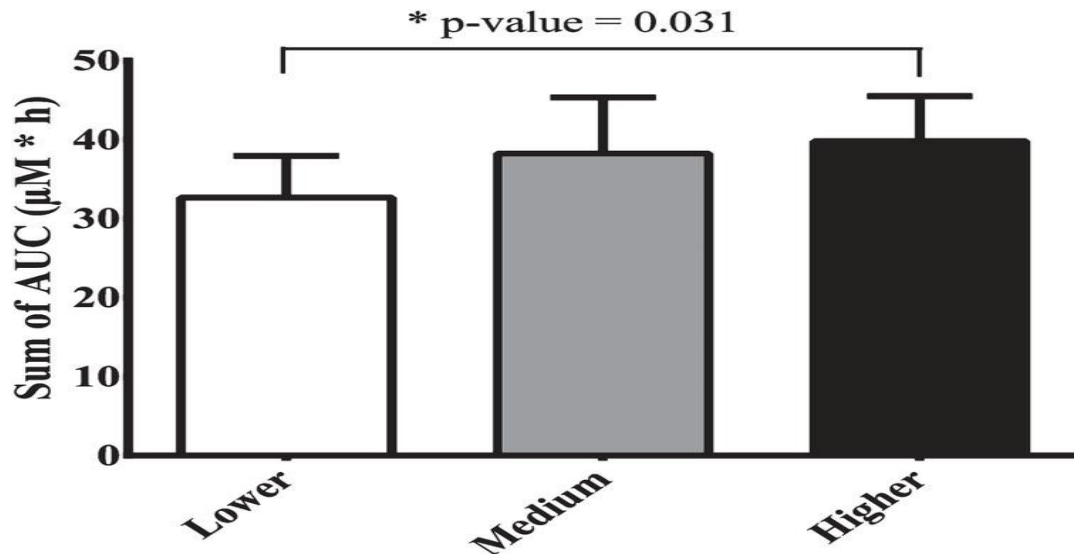
Blueberries may help promote hair growth (due to the presence of proanthocyanidins), thwart premature graying as well as prevent or delay ocular problems, including macular degeneration, cataracts, myopia, hypermetropia, dryness and retinal infections. They improve binocular vision due to their vasoactive properties; they dilate the blood capillaries in the eye muscles, thus improving circulation and therefore vision. A multitude of studies have documented positive correlations between blueberry intake and night-time visual acuity, reduced eyestrain and quicker adjustment to darkness. These effects are due to high antioxidant content (carotenoids and flavonoids). Consequently, blueberries are often referred to as “the vision fruit.” Additionally, blueberries contain ample vitamin B12, helping prevent the onset of pernicious anemia, of which gray hair is a symptom. Overall, they help increase longevity (HealWithFood, 2018; OrganicFacts, 2018; Panda, 2017).

Willy Kalt, an Agriculture Canada research scientist, asserts that half a cup of blueberries daily would be sufficient to promote optimal health. Unfortunately, however, most people consume only approximately half a cup of wild blueberries per year. It is noted that wild berries (low bush) outperform cultivated berries since the latter are bred for sweetness. For example, one (1) cup of regular blueberries provides one with 25% of the RDV of manganese, while wild blueberries provide 200% (as noted earlier). The latter also provide 24% of one’s RDV of vitamin C and 36% RDV of one’s vitamin K, with wild blueberries yielding even greater values (Leech, 2017). Furthermore, out of 150 wild varieties in Ontario, Quebec and the East Coast, it is found that “Newfoundland’s abundant crop has the highest antioxidant count” (Jones, 2005).



Laboratory Graph A:

The below graph shows the bioavailability of (poly)phenols expressed as the sum of areas under the curve (AUC) ( $\mu\text{M}\cdot\text{h}$ ) of 23 metabolites detected in plasma by LC-Q-TOF MS after ingestion of different intake levels of blueberry beverages. The results are presented as average  $\pm$  standard error of the mean (n=9).



### Conclusion

Blueberries, particularly wild blueberries from Newfoundland, yield numerous health benefits, including the promotion of digestive, ocular and urinary tract health. It should be reiterated, however, that the benefits associated with wild blueberry intake are vast and are therefore beyond the scope of this discourse. The scientific literature indicates that wild blueberries are far superior to regular ones – for example, the former possesses more potent antioxidant properties and contains a greater number of various nutrients, ranging from vitamin B6 and folate to potassium and manganese. Moreover, it is evident that the most healthful wild blueberries are grown in Newfoundland. Iron Berry, based in Newfoundland, produces a variety of organic wild blueberry products that can be easily incorporated into one's daily dietary regimen. Further, they operate in accordance with the principles of environmentalism, accountability, education and quality, which are especially significant in a consumer market lacking these ideals. Ultimately, buyers are encouraged to consume wild blueberry products, particularly those produced by Iron Berry, to accrue the plethora of benefits packed in these tiny, delicious berries.

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