

A Brief Review of Recent Research on the Potential Benefits of Dietary Supplementation with Polyphenols as Found in Red, Red/Purple and Blue Fruits and Berries

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Super-Fruits: The Power of Polyphenols

Phytonutrients, from *phyto* meaning “plant” in Greek, are certain organic compounds known to promote human health, though most are not essential for life. The major classifications of phytochemicals in foods are polysaccharides, terpenes, organic sulfurs, organic acids, amines and polyphenols. **Polyphenols** may be sub-classified as *non-flavonoids* and *flavonoids*, as exemplified by the following:

Non-flavonoids: ellagic acid (strawberries, blueberries, raspberries), stilbenes (*resveratrol* in grape skins, peanuts, Japanese Knotweed AKA *Polygonum cuspidatum*)

Flavonoids: anthocyanins (purple, red/purple, and blue fruits and berries, purple cabbage, beets, grape seed extract); catechins (tea, wine, cocoa, coffee); flavanones (citrus bioflavonoids); flavones (fruits and vegetables); flavonols (fruits and vegetables, tea, wine, onion, apple skin, *quercetin*); isoflavones (soybeans)

Recent evidence demonstrates that plant polyphenols have numerous benefits such as helping improve endothelial function, inhibiting abnormal platelet aggregation, supporting healthy blood lipids, fighting inflammation, quenching free radicals, enhancing endogenous antioxidant enzymes, and up-regulating cyclic AMP (cAMP) and mitochondrial biogenesis.¹ In 2005, The 1st International Conference on Polyphenols and Health strongly suggested consuming more polyphenols for helping prevent degenerative diseases, especially cardiovascular disorders and cancer.² It is therefore not surprising that fruits and berries rich in polyphenols, and the extracts, are being marketed as “Super-Fruits”.

What the Experts Are Saying

Functional foods and drinks fortified with the so called “**Super-Fruits**” are usually very high in polyphenols. Well they should be considering the indications of their vast array of potential benefits, as briefly touched upon from the following small sample of the plethora of current scientific studies.

Extracts from **blackcurrants**, rich in *anthocyanins*, may reduce inflammation in the lungs and potentially offer benefits to the increasing number of asthmatics, perhaps best in the form of functional foods according to researchers.³ Antioxidant-rich extracts of **blueberries** in a dose-dependent manner may counter the detrimental effect oxidative stress caused by excessive exercise.⁴

A water-soluble citrus bioflavonoid mixture, without added vitamin C, was found capable of inhibiting the increased capillary permeability caused by an inflammatory exudate, acting as an anti-inflammatory over a larger pH range of exudates than even cortisone!⁵ Orange juice, naturally rich in **citrus bioflavonoids**, may help prevent the negative effects of the free radical and endotoxin cascade that follows a high-fat, high-carbohydrate meal.⁶ **Berries (bilberries, blackcurrants, cranberries and strawberries)** rich in polyphenols decreased the postprandial glycemic response of sucrose in healthy subjects, adding more evidence to their potential for lowering risk of obesity, diabetes and cardiovascular disease (CVD).⁷

Data was just presented as part of the scientific program of the American Society for Nutrition at the Experimental Biology, April 2010 meeting in Anaheim showing that extracts from the **chokeberry**, which contains five times the amount of flavonoids and anthocyanins as cranberries, may prevent weight gain in pre-diabetics and affect genes linked to the development of fat tissue and related inflammatory pathways. Furthermore, the chokeberry-supplemented group was found to have lower blood glucose and reduced levels of plasma triglycerides, cholesterol, and low-density lipoprotein (LDL) cholesterol. Together these findings suggest potential in lowering heart disease and diabetes risk. Other studies have shown that black chokeberry tends to regulate immune function in patients with breast cancer, suppress the growth of human colon cancer cells, allow less oxidative damage to red blood cells during vigorous exercise and lower blood pressure 11 mmHg systolic and 7 mmHg diastolic!⁸⁻¹⁰

Another study presented at the Experimental Biology Convention in Anaheim, California showed **grape** consumption lowered blood pressure, improved heart function and reduced other risk factors for heart disease and metabolic syndrome, such as reduced inflammatory indicators in the heart and blood, lower triglycerides and improved glucose tolerance. "*The possible reasoning behind the lessening of metabolic syndrome is that the phytochemicals were active in protecting the heart cells from the damaging effects of metabolic syndrome.*" said presenter Steven Bolling, M.D., heart surgeon at the University of Michigan Cardiovascular Center and head of their Cardioprotection Research Laboratory.

Resveratrol, naturally rich in grape skins, is a polyphenol that Harvard researchers had discovered led to a 25% increase in lifespan in mice. Furthermore, studies from France showed that mice fed resveratrol did not gain weight as compared to controls when given a high-fat and high-calorie diet. Beyond this, a number of other studies have demonstrated the non-flavonoid polyphenol resveratrol to have antioxidant, anti-cancer, anti-inflammatory, and cardioprotective properties.¹¹ Resveratrol, along with quercetin, also increases cyclic AMP through mitochondrial biogenesis, which likely relates to their life extending and sports performance enhancing properties.¹²

The high polyphenol (*procyanidin*) content of **apples** is largely responsible for their ability to lower blood cholesterol, inhibit triglyceride absorption and abdominal fat accumulation, and enhance insulin sensitivity.¹³⁻¹⁶ In addition, apple polyphenols have the potential to reduce allergic conditions by blocking the release of histamine.¹⁷⁻²²

Grape seed extract contains high levels of procyanidin dimers that have been shown to be potent inhibitors of aromatase, displaying potential usefulness in the prevention/treatment of hormone-dependent breast cancer.²³ Polyphenol rich **pomegranate** juice possess anti-atherosclerotic and anti-hypertensive properties, acting both as a powerful antioxidant and as an *angiotensin converting enzyme* (ACE) inhibitor, lowering systolic blood pressure by 5 percent.²⁴

WellBerry™, Super-Fruit Synergy?

Wellberry™ is not an actual fruit. It is a unique patented combination of **Indian Gooseberry**, AKA **Amla fruit** and a patent pending form of vegetable fatty acid form of vitamin C plus bioflavonoids, called **PureWay-C™**.

By itself, Amla has been shown to reduce the effect of aging on renal dysfunction related to oxidative stress and significantly reduced systolic blood pressure. Amla may therefore useful for the prevention of age-related renal disease.^{25,26} Amla has also been shown to help protect smokers and benefit as a natural skin care ingredient.^{27,28}

By itself, the above new vegetable fatty acid form of vitamin C with bioflavonoids has been shown to possess the best absorption and retention rates of any commercial form of Vitamin C.^{29,30} It is proven to be more rapidly absorbed and lead to higher serum vitamin C levels and greater vitamin C.^{31,32}

However, when this new vegetable fatty acid form of vitamin C with bioflavonoids is mixed together with amla fruit extract in an aqueous solution, the combination displayed greater antioxidant capacity than was predicted based on the sum of their individual antioxidant values.³³

Polyphenols: The More the Merrier?

Even polyphenols from different plants seem to work synergistically when consumed together, with benefits from the combination again equaling more than the sum of the parts.³⁴ For example, amla has been shown to increase the antioxidant power of other polyphenols (anthocyanins in pomegranate), in a dose dependant manner in both *in vitro* and *ex vivo* models.³⁵

Indeed, in a very recent study, concentrates of berry powder (bilberry, blackberry, black currant, blueberry, cranberry, Concord grape, elderberry, raspberry and red currant) plus a vegetable powder (Acerola cherry, apple, beet, broccoli, cabbage, carrot, cranberry, kale, orange, peach, papaya, parsley, pineapple, spinach, and tomato) have been shown to reduce inflammatory biomarkers by between 16 and 35 per cent. The authors concluded, "the close relationship between chronic inflammation and poor human health, suggests such a juice concentrate is a beneficial addition to the habitual diet in support of human health."³⁶

Mother Nature's bounty of polyphenols appear to combat free-radical damage and inflammation thereby potentially lowering the risk of cardiovascular disease, high blood pressure, diabetes, cancer, and all too common allergic conditions. Furthermore, it appears that taken together the sum of potential protections and benefits is greater than the individual food, extract or supplement.

The take home message is nothing new. Almost everyone should consume 7-9 daily servings or more of fruits and vegetables of all the colors. This includes the polyphenols which are generally richest in the red/purple berries, pomegranates and blueberries. For those desiring the benefits of polyphenols, but for what ever reason must avoid them or find it difficult to consume them daily (always the best way), current science appears to support supplementing with fruit and vegetable juice powders rich in polyphenols as the next best thing.

References

1. Laurie Barclay, MD. The Disease-Fighting Power of Polyphenols. LE Magazine Febuary 2008
2. Scalbert A, Johnson IT, Saltmarsh M. Polyphenols: antioxidants and beyond. *Am J Clin Nutr.* 2005 Jan;81(1 Suppl):215S-7S.
3. Hurst SM, et al. Blackcurrant proanthocyanidins augment IFN-gamma-induced suppression of IL-4 stimulated CCL26 secretion in alveolar epithelial cells. *Molecular Nutrition and Food Research.* Published online ahead of print, doi:10.1002/mnfr.200900297
4. Hurst, RD, et al. Blueberry fruit polyphenolics suppress oxidative stress-induced skeletal muscle cell damage in vitro". *Molecular Nutrition & Food Research*, Volume 54 Issue 3, Pages 353-363
5. Menkin V. Anti-inflammatory activity of some water-soluble bioflavonoids. *Am J Physiol* 196: 1205-1210, 1959
6. Ghanim H, Sia CL, Upadhyay M, et al. Orange juice neutralizes the proinflammatory effect of a high-fat, high-carbohydrate meal and prevents endotoxin increase and Toll-like receptor expression. *Am J Clin Nutr.* 2010 Apr;91(4):940-9
7. Törrönen C, et al. Berries modify the postprandial plasma glucose response to sucrose in healthy subjects. *British Journal of Nutrition* (2010), 103:1094-1097
8. Valcheva-Kuzmanova SV, Belcheva A. Current knowledge of Aronia melanocarpa as a medicinal plant. *Folia Med (Plovdiv)*.2006;48(2):11-7
9. Pilaczynska-Szczesniak L, Skarpanska-Steinborn A, Deskur E, Basta P, Horoszkiewicz-Hassan M. The influence of chokeberry juice supplementation on the reduction of oxidative stress resulting from an incremental rowing ergometer exercise. *Int J Sport Nutr Exerc Metab.* 2005 Feb;15(1):48-58
10. Naruszewicz M, Laniewska I, Millo B, Dłuniewski M. Combination therapy of statin with flavonoids rich extract from chokeberry fruits enhanced reduction in cardiovascular risk markers in patients after myocardial infraction (MI). *Atherosclerosis.* 2007 Oct;194(2):e179-4.
11. Smoliga JM, Bost J, Maroon JC. Potential Benefits of Resveratrol Supplementation for Optimizing Health and Preventing Chronic Disease. *Antiaging Therapeutics*, Vol. 11, Chapter 46
12. Chowanadisai W, et al. Pyrroloquinoline Quinone Stimulates Mitochondrial Biogenesis through cAMP Response Element-binding Protein Phosphorylation and Increased PGC-1α Expression. *The Journal of Biological Chemistry*, January 1, 2010, 285, 142-152.
13. Akazome Y, Kanda T, Ikeda M, Shimasaki H. Serum cholesterol-lowering effect of apple polyphenols in healthy subjects. *J Oleo Sci.* 2005;54:143.
14. Sugiyama H, Akazome Y, Shoji T, et al. Oligomeric procyanidins in apple polyphenol are main active components for inhibition of pancreatic lipase and triglyceride absorption. *J Agric Food Chem.* 2007 May 30;55(11):4604-9.

15. Ogino Y, Osada K, Nakamura S, et al. Absorption of dietary cholesterol oxidation products and their downstream metabolic effects are reduced by dietary apple polyphenols. *Lipids*. 2007 Mar;42(2):151-61.
 16. Ohta Y, Sami M, Kanda T, Saito K, Osada K, Kato H. Gene expression analysis of the anti-obesity effect by apple polyphenols in rats fed a high fat diet or a normal diet. *J Oleo Sci*. 2006;55(6):305-14.
 17. Ohta Y, Funayama M, Seino H, et al. Apple polyphenol improves lipid metabolism and insulin independence in obese rats. *Nippon Shokuhin Kagaku Kogaku Kaishi*. *J Oleo Sci*. 2007;54(6):287-94.
 18. Osada K, Suzuki T, Kawakami Y, et al. Dose-dependent hypocholesterolemic actions of dietary apple polyphenol in rats fed cholesterol. *Lipids*. 2006 Feb;41(2):133-9.
 19. Nagasako-Akazome Y, Kanda T, Ohtake Y, Shimasaki H, Kobayashi T. Apple polyphenols influence cholesterol metabolism in healthy subjects with relatively high body mass index. *J Oleo Sci*. 2007;56(8):417-28.
 20. Kanda T, Akiyama H, Yanagida A, et al. Inhibitory effects of apple polyphenol on induced histamine release from RBL-2H3 cells and rat mast cells. *Biosci Biotechnol Biochem*. 1998 Jul;62(7):1284-9.
 21. Tokura T, Nakano N, Ito T, et al. Inhibitory effect of polyphenol-enriched apple extracts on mast cell degranulation in vitro targeting the binding between IgE and FcεpsilonRI. *Biosci Biotechnol Biochem*. 2005 Oct;69(10):1974-7.
 22. Enomoto T, Nagasako-Akazome Y, Kanda T, Ikeda M, Dake Y. Clinical effects of apple polyphenols on persistent allergic rhinitis: A randomized double-blind placebo-controlled parallel arm study. *J Investig Allergol Clin Immunol*. 2006;16(5):283-9.
 23. Kijima I, Phung S, Hur G, Kwok SL, Chen S. Grape seed extract is an aromatase inhibitor and a suppressor of aromatase expression. *Cancer Res*. 2006 Jun 1;66(11):5960-7.
 24. Aviram M, Dornfeld L. Pomegranate juice consumption inhibits serum angiotensin converting enzyme activity and reduces systolic blood pressure. *Atherosclerosis*. 2001 Sep;158(1):195-8.
 25. Yokozawa T, et al. Amla attenuates age-related renal dysfunction by oxidative stress. *J Agric Food Chem*. 2007 Sep 19;55(19):7744-52.
 26. Yokozawa T, et al. Amla attenuates age-related renal dysfunction by oxidative stress. *J Agric Food Chem*. 2007 Sep 19;55(19):7744-52.
 27. Block, G., et al. 2004. Plasma C-reactive protein concentrations in active and passive smokers: Influence of antioxidant supplementation. *J. Am. College Nutr*.23:141-147.
 28. Chaudhuri, R., 2002. Emblica cascading antioxidant: A novel natural skin care ingredient. *Skin Pharmacol. Appl. Skin Physiol*.15:374-380.
 29. Pancorbo, D., et al. Vitamin C-lipid metabolites: Uptake and retention and effect on plasma C-reactive protein and oxidized LDL levels in healthy volunteers. *Med Sci Monit*. 2008 Nov;14(11):CR547-51.
 30. Weeks B, Perez P. A novel vitamin C preparation enhances neurite formation and fibroblast adhesion and reduces xenobiotic-induced T-cell hyperactivation. *Med. Sci. Monit*. 13(3):BR51-58.2007
 31. Weeks B, and Perez P. Absorption rates and free radical scavenging values of vitamin C-lipid metabolites in human lymphoblastic cells. *Med. Sci. Monit*.13(10):BR205-210.2007
 32. Pancorbo D, Vazquez C, Fletcher MA. Vitamin C-lipid metabolites: uptake and retention and effect on plasma C-reactive protein and oxidized LDL levels in healthy volunteers. *Med Sci Monit*. 2008 Nov;14(11):CR547-51
 33. NutraGenesis Introduces Wellberry(TM) branded superfruit ingredient, *Nutritional Products Insider*, 2008-08-04
<http://www.npicenter.com/anm/templates/newsATemp.aspx?articleid=21789&zoneid=8>.
 34. Ibid. 1
 35. Ibid. 33
 36. Jin Y, et al. "Systemic inflammatory load in humans is suppressed by consumption of two formulations of dried, encapsulated juice concentrate". *Molecular Nutrition & Food Research*. Published online ahead of print, doi: 10.1002/mnfr.200900579
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