

The Science of the Superfruit

RESEARCHING THE HEALTH BENEFITS OF WILD BLUEBERRIES

Wild
Blueberries™



The Benefits of Blue:

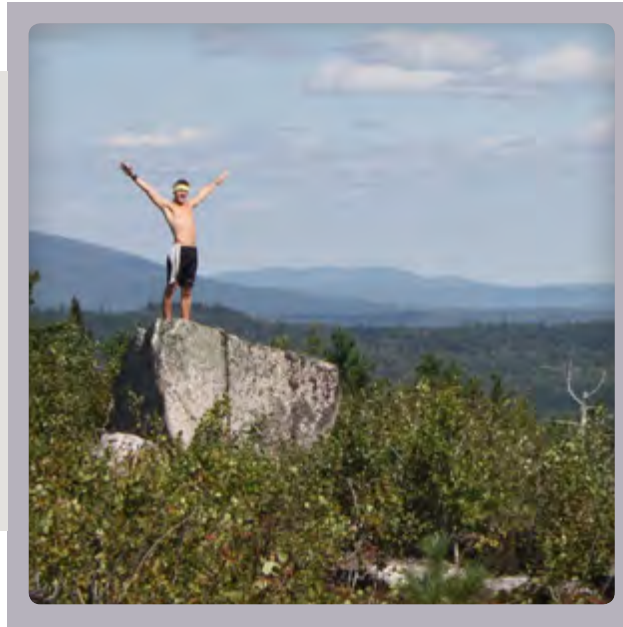
The links between blueberries and **your health**

Scientists around the world are investigating the disease-fighting potential of blueberries – and the quantity of this research is growing by leaps and bounds. Studies of these antioxidant-rich super berries and the bioactive phytonutrients that give them their deep-blue color reveal a wide range of potential health benefits. From brain health, gut and heart health to cancer prevention, improved urinary tract function and a reduction in diabetes risk, blueberry research is changing the way we all look at this tiny, potent berry!



“More and more people in a wider range of fields of biomedicine are looking at *wild blueberries*... it’s a very exciting time to be involved in this field.”

– Wilhelmina Kalt, PhD, Food Chemist, Agriculture and Agrifoods, Canada



ANTIOXIDANT RESEARCH

Total Antioxidant Capacity

Wild Blueberries have the highest antioxidant capacity per serving, compared with more than 20 other fruits. Using the Oxygen Radical Absorbance Capacity (ORAC) testing procedure, Ronald Prior, Ph.D., found that a one-cup serving of Wild Blueberries had more total antioxidant capacity than a serving of cranberries, strawberries, plums, raspberries and even cultivated blueberries.

Wu X, Beecher GR, Holden JM, Haytowitz DB, Gebhardt SE, Prior RL. - *ORAC of Selected Foods, USDA-ARS, May 2010 - Journal of Agricultural and Food Chemistry. 2004; 52:4026-4037*

Cellular Antioxidant Activity

Wild Blueberries also outperformed selected fruits in an advanced procedure known as the cellular antioxidant activity (CAA) assay, an innovative means of measuring antioxidant activity inside cells. A Cornell University team led by Dr. Rui Hai Liu conducted the study.

Wolfe KL, Liu RH - *Journal of Agricultural and Food Chemistry. 2008; 56(18): 8418-8426 - Journal of Agricultural and Food Chemistry. 2007; 55(22): 8896-8907*

Fighting Oxidative Stress

USDA scientists concluded that eating Wild Blueberries and other antioxidant-rich foods at every meal helps prevent oxidative stress, which is linked to chronic diseases and aging. This study advances antioxidant research by moving beyond the measurement of antioxidants in foods to actual examination of the performance of specific fruits against oxidative stress in the body.

Prior RL, Gu L, Wu X, Jacob RA, Sotoudeh G, Kader AA, Cook RA - *Journal of the American College of Nutrition. 2007; 26(2): 170-181*

While the application of antioxidant values to specific health outcomes is currently being debated, it is clear that diets containing foods with high antioxidant values such as fruits and vegetables are associated with reduced risk of disease.

BRAIN HEALTH

Memory and Motor Skills

In 1999, James Joseph, Ph.D., and his team at the USDA Human Nutrition Research Center on Aging at Tufts University first reported that a diet of blueberries may improve motor skills and reverse short-term memory loss.

Joseph JA, Shukitt-Hale B, Denisova NA, Bielinski D, Martin A, McEwen JJ, Bickford PC.

- *Journal of Neuroscience. 1999; 19(18): 8114-8121*

Berry Extracts and Brain Aging

A team led by Shibu Poulose, Ph.D., at the USDA Human Nutrition Center on Aging studied the build-up of biochemical debris in the brain, which they believe contributes to the decline of mental functioning with age. His team found that extracts from blueberries and other deeply colored berries enable "housekeeper" cells in the brain to remove the toxic chemicals before they do damage.

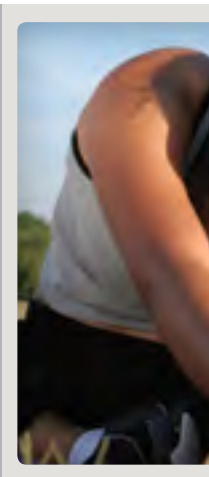
- *American Chemical Society Abstract, Aug. 23, 2010*

Improving Memory Function

In the first human study of its kind, researchers demonstrated that anthocyanin-rich Wild Blueberries are highly beneficial in maintaining memory function. The study, conducted by a team led by Dr. Robert Krikorian at the University of Cincinnati, confirmed that Wild Blueberry supplemented diets improved memory function and mood in older adults with early memory decline.

Krikorian R, Shidler MD, Nash TA, Kalt W, Vinqvist-Tymchuk MR, Shukitt-Hale B, Joseph JA

- *Journal of Agricultural and Food Chemistry. 2010; 58, 3996-4000*



Researchers are going *wild* for

Alzheimer's Disease

In 2003, Dr. Joseph and his team reported that it may be possible to overcome genetic predispositions to Alzheimer's disease through diet. They demonstrated the protective effects of blueberry supplementation on memory in laboratory mice.

Joseph JA, Denisova NA, Arendash G, Gordon M, Diamond D, Shukitt-Hale B, Morgan D.
- *Nutritional Neuroscience*. 2003; 6: 153-162

Flavonoids Slow Cognitive Decline

A team led by Dr. Elizabeth Devore of Brigham and Women's Hospital and Harvard Medical School has determined that regular consumption of blueberries and strawberries may help curb cognitive decline among older adults. The study used a sample of more than 16,000 women from the Nurses' Health Study. Findings suggest that eating one or more servings of blueberries each week may help slow cognitive degeneration by several years.

Devore EE, Kang JH, Breteler MM, Grodstein F
- *Annals of Neurology*. April 2012; doi: 10.1002/ana.23594. [Epub ahead of print]

Improving Brain Function in Children

Preliminary research from the University of Reading (UK) reveals that anthocyanins, a group of flavonoids that are found in high concentrations in Wild Blueberries, may have beneficial effects on memory and attentional processing in school age children.

Whyte AR, Williams CM
- *Appetite*. October 2012; 59(2), 637.

FIGHTING CANCER

Triple Negative Breast Cancer

Research conducted by Shivan Chen, Ph.D., and Lynn Adams, Ph.D., of the Beckman Research Institute of the City of Hope, Duarte, CA, has demonstrated the potential of blueberries to inhibit the growth of Triple Negative Breast Cancer (TNBC), a particularly aggressive and hard to treat form of breast tumor.

Adams LS, Kanaya N, Phung S, Liu Z, Chen S.
- *The Journal of Nutrition*, August 31, 2011; doi:10.3945/jn.111.140178

Inhibiting Cancer Growth

Studies conducted by Mary Ann Lila, Ph.D., Department of Natural Resources and Environmental Sciences, University of Illinois, Urbana-Champaign, indicate that compounds in Wild Blueberries may be effective inhibitors of both the initiation and promotion stages of cancer.

Schmidt BM, Howell AB, McEniry B, Knight CT, Seigler D, Erdman JW Jr, Lila MA
- *Journal of Agricultural and Food Chemistry*. 2004; 52(21): 6433-6442;
- *Journal of Food Science*. 2000; 65(2)

GUT HEALTH

Promoting Good Bacteria

Beneficial intestinal microflora play a critical role in digestive health and the immune system. Researchers from the University of Milan and the University of Maine, led by Dr. Stefano Vendrame, conducted clinical studies showing that regular consumption of a Wild Blueberry drink favorably affects the composition of the intestinal microbiota by increasing a type of beneficial bacteria called Bifidobacteria.

Vendrame S, Guglielmetti S, Riso P, Arioli S, Klimis-Zacas D, Porrini M.
- *Journal of Agricultural and Food Chemistry*, 2011, 59 (24):12820



Cardiovascular Protection

A study demonstrating potential cardiovascular protection by blueberries showed that blueberry diets lowered blood pressure, preserved kidney vascular function and prevented oxidative stress by raising antioxidant defenses in kidneys in an animal model.

Elks CM, Reed SC, Mariappan N, Shukitt-Hale B, Joseph JA, Ingram DK, Francis JJ
- *PLoS ONE*. September 2011; 6(9): e24028

Improving Heart Health

Researchers in Germany and UK have used state-of-the-art techniques to demonstrate that Wild Blueberries can improve vascular function in healthy men. In their study, researchers learned that the polyphenols in Wild Blueberries may help blood vessels to function better and remain healthier, meaning the heart does not have to work as hard to circulate blood through the body.

Rodriguez-Mateos A, Rendeiro C, Bergillos-Meca T, Tabatabaee S, George TW, Heiss C, Spencer JPE
- *American Journal of Clinical Nutrition Abstract*. September 2013.

METABOLIC SYNDROME

Hypoglycemic Activity

Working with Wild Blueberry fruit compounds known as anthocyanins, Mary Ann Lila, Ph.D., from North Carolina State University, and her team demonstrated that blueberry phytochemicals helped alleviate hyperglycemia in rodent models, a condition associated with diabetes and metabolic syndrome.

Grace MH, Ribnicky DM, Kuhn P, Poulev A, Logendra S, Yousef GG, Raskin I, Lila MA
- *Phytomedicine*, 2009 May; 16:950: 406-15

Therapeutic Properties

A team looking at the therapeutic roles of blueberries, strawberries and cranberries in metabolic syndrome reported that blueberries have been shown to lower systolic and diastolic blood pressure and lipid oxidation and improve insulin resistance.

Basu A, Lyons TJ
- *Journal of Agriculture and Food Chemistry*, 2011 Nov 29.

Improving Gastrointestinal Health

Research conducted by scientists at the University of Maine reveals Wild Blueberries promote better gastrointestinal and digestive health, a significant finding due to gut health's key role in overall immune system health. In the study, researchers found that rats fed a diet of Wild Blueberries showed an increase in probiotics, bacteria beneficial to overall gut health.

Lacombe A, Li RW, Klimis-Zacas D, Kristo AS, Tadepalli S, Krauss E, Young R, Wu VCH
- *PLoS ONE*, 2013. 8(6): e67497.

HEART HEALTH

Fighting Atherosclerosis

Dr. Xanli Wu and colleagues at the Arkansas Children's Nutrition Center in Little Rock demonstrated the health benefits of Wild Blueberries in preventing atherosclerosis. Atherosclerotic heart disease is the build-up of plaque in the artery wall starting as fatty streaks, primarily made up of immune cells (macrophages), in which cholesterol is accumulated. Previously, Dr. Wu's group showed that Wild Blueberry-fed animals developed fewer plaques in the aorta compared to controls. Recently, the team showed that two receptors in macrophages were significantly down regulated in the Wild Blueberry-fed animals.

Xie C, Kang J, Chen JR, Lazarenko OP, Ferguson ME, Badger TM, Nagarajan S, Wu X.
- *Food & Function*. October 2011;2(10):588-94

Addressing Heart Attack Risk

A Harvard School of Public Health study finds that three or more servings of blueberries and strawberries per week may slash a woman's risk of heart attack by as much as 33%. Researchers attributed benefits to the berries' high anthocyanin content, which may help dilate arteries and provide other cardiovascular benefits.

Aedin Cassidy, Kenneth J. Mukamal, Lydia Liu, Mary Franz, A Heather Eliassen, Eric B. Rimm
- *Circulation: Journal of the American Heart Association*. 2013; 127: 188-196

Reducing Cholesterol

In 2010, a team of scientists studying cholesterol-lowering effects in laboratory hamsters reported that a blueberry-enhanced diet lowered total plasma cholesterol and VLDL (very low density lipoprotein) levels.

Kim H, Bartley GE, Rimando AM, Yokoyama W.
- *Journal of Agriculture and Food Chemistry*. 2010 Apr 14; 58(7): 3984-91

Research shows that blueberries may support cardiovascular health through cholesterol lowering effects. A research team at Agriculture and Agri-Food Canada led by Wilhelmina Kalt, Ph.D., found that blueberry supplementation reduced plasma cholesterol levels in pigs.

Kalt W, Foote K, Filmore SA, Lyon M, Van Lunen TA, McRae KB
- *British Journal of Nutrition*. 2008; 100(1): 70-78
Reducing Cholesterol

Blueberries!

REDUCING DIABETES RISK

Increasing Insulin Sensitivity

A study led by Dr. April Stull and William Cefalu, MD of the Pennington Biomedical Research center at Louisiana State University found that daily consumption of whole blueberries helped people with a high risk for type 2 diabetes reduce that risk. The bioactives in blueberries increased the participants' insulin sensitivity, a key factor in preventing type 2 diabetes.

Stull AJ, Cash KC, Johnson WD, Champagne CM, Cefalu WT.
- *Journal of Nutrition*. 2010 Oct; 140(10): 1764-8

Flavonoids and Type 2 Diabetes

Researchers at the Harvard School of Public Health found that eating more anthocyanin-rich fruits such as blueberries, apples and pears

may lower diabetes risk. Their findings showed an association between increased consumption of the flavonoid anthocyanin, the pigment responsible for the deep blue color of blueberries, and a lower risk of type 2 diabetes.

Wedick NM, Pan A, Cassidy A, Rimm EB, Sampson L, Rosner B, Willett W, Hu FB, Sun Q, van Dam RM.
- *Am J Clin Nutr*. 2012 Apr; 95(4):925-33.
- *Epub* 2012 Feb 22.

URINARY TRACT HEALTH

At the Rutgers University Blueberry Cranberry Research Center, Amy Howell, Ph.D., showed that blueberries, like cranberries, contain compounds that prevent the bacteria responsible for urinary tract infections from attaching to the bladder wall.

Journal of Agricultural and Food Chemistry. 2004 52(21): 6433-6442;
- *New England Journal of Med*

BLUEBERRIES AND EXERCISE

Reducing Inflammation and Burning Fat

Researchers in North Carolina have discovered that combining blueberries with exercise offers two potential health benefits – the ability for the body to burn fat longer after exercise, and improved absorption of inflammation-reducing antioxidant compounds called polyphenols.

Nieman DC, Gillitt ND, Knab AM, Shanely RA, Pappan KL, Jin FF, Lila MA
- *PLoS ONE*, 2013. 8(8): e72215.

All the blueberry research
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Want to learn more about the benefits of blue? Start at wildblueberries.com/researchdatabase, where you'll find the Wild Blueberry Association Research Library™: the most comprehensive resource for blueberry and bilberry research on the web. Also on the Wild Blueberries website:

- **The Wild Blueberries—Health Heroes Video.** Meet some of the scientists who are active in this field and learn about the scope of their research findings.
- **All Things Wild Blueberry.** Where they come from, where to buy them, how to use them, why they're good for you...all this and much more.

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