

Stroke Prevention in a Nutshell

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The endothelial cells lining our blood vessels make a gaseous “messenger” known as **nitric oxide (NO)** that functions to ward off inflammation, atherosclerosis, and the inappropriate formation of blood clots. There is considerable evidence that efficient production of NO by the blood vessels feeding the brain is of fundamental importance for stroke prevention.¹⁻³ Fortunately, there are a number of practical lifestyle strategies that can promote NO production by the vasculature. As I put it in one of my publications, “Just Say NO to Stroke”!¹

Cocoa flavanols/queracetin. Certain flavonoid phytochemicals found in foods can act directly on endothelial cells to activate the enzyme which makes NO, known as NO synthase. Epicatechin, a flavanol richly supplied by raw cocoa powder, is one of these;⁴⁻⁶ quercetin, found in many fruits such as apples, appears to have similar activity.⁷⁻¹⁰ The Kuna Indians of Panama, whose traditional lifestyle entails drinking 4 or so servings daily of raw cocoa, are noted for their virtual absence of hypertension and stroke.¹¹⁻¹³ Consumption of flavanol-rich cocoa has been reported to acutely increase blood flow to brain gray matter.¹⁴ To achieve an optimal intake of these protective factors, I suggest several servings daily of a cocoa flavanol product, **CocoaVia™**, and/or several capsules daily of **quercetin** (~ 200 mg). These should be dispersed throughout the day.

Spirulina. Oxidative stress produced by endothelial cells is very detrimental to vascular health, in large part because it impairs the bioactivity of NO. Oxidative stress is capable of “uncoupling” NO synthase, changing it to form that makes the dangerous oxidant superoxide rather than NO. Also, superoxide can react spontaneously with NO to convert it to the oxidant peroxynitrite, destroying its protective bioactivity in the process. So oxidative stress can be viewed as the evil antagonist of the key protection afforded by NO. Fortunately, it has recently been discovered that spirulina – a cyanobacterium (algae) used traditionally as a food by the Aztecs - contains a phytonutrient, known as **phycocyanobilin (PhyCB)**, that inhibits the key source of oxidative stress in the vasculature, NADPH oxidase.¹⁵⁻¹⁷ Quelling NADPH oxidase activity not only is useful for prevention of stroke, but in rodent studies also aids preservation of brain neurons when rodents are subjected to an artificial stroke by temporary occlusion of the carotid arteries.¹⁸⁻²¹ That likely explains why pre-administration of PhyCB has been found to protect the brains of rodents subjected to such strokes.^{22, 23} It has been estimated that an intake of 15-30 g of spirulina may be needed to achieve the optimal antioxidant benefits of spirulina seen in rodent studies;¹⁵ this amounts to **1-2 rounded tablespoons daily**. Unfortunately, spirulina is not inherently appetizing – its flavor is rather disagreeable, and its odor is worse – but its flavor can be masked when it is incorporated into smoothies. A practical way to get an intake of 15 g is with the product **Chocolatl Verde**. This is a powder that can be blended with a cup of soy milk (I recommend Silk™ Vanilla Soy Milk) or other suitable base, and also contains cocoa powder and 200 mg of quercetin per serving.

Potassium and Sodium. Individuals and societies which get an ample dietary intake of potassium are considerably less likely to suffer strokes.²⁴⁻²⁷ This may reflect the fact that a small rise in blood potassium level tends to boost endothelial production of NO while quelling that of superoxide.²⁸⁻³⁰ Potassium also

aids renal excretion of sodium, which in excess greatly increases stroke risk.³¹ And increased potassium intakes tend to modestly lower elevated blood pressure, a key risk factor for stroke.³² You can increase your potassium intake by increasing your intake of foods characteristically high in this mineral, such as **bananas, coconut water, potatoes, yams, or Low-Sodium V8™ Juice**, and also by **emphasizing whole foods in your diet**. Most foods naturally have a meaningful content of potassium. But when we eat refined grains, or add sugars or oils to our diet, we dilute the good potassium content of natural foods with calories that are “empty”, at least from the standpoint of potassium. While keeping your potassium intake high, it is also smart to avoid foods that are overtly salty, and make sparing use of the salt shaker. A high-salt diet increases risk for stroke independent of its often adverse impact on blood pressure.³³⁻³⁷ It’s no accident that societies in which salt intake has been typically high, such as Japan and Finland, have been characterized by high stroke risk. Intriguingly, stroke is virtually absent on the island of Kitava, where salt intake is about a quarter as high as in the U.S., and potassium intake about 3 times higher.³⁸ Natural whole foods are inherently low in sodium, but provide worthwhile amounts of potassium – so a lightly-salted natural foods diet is a convenient way to keep your dietary potassium/sodium ratio high and protect your cerebrovascular health.

Citrulline. Our endothelial cells can make a compound known as ADMA (asymmetric dimethylarginine) that acts as a competitive inhibitor of NO synthase. Not surprisingly, people with elevated levels of ADMA have been found to be at increased risk for stroke.³⁹⁻⁴⁴ Fortunately, the adverse impact of ADMA on NO synthase activity can be offset by boosting endothelial levels of this enzyme’s natural substrate, the amino acid arginine. And this can best be achieved by supplemental intakes of arginine’s biosynthetic precursor, citrulline.⁴⁵⁻⁴⁹ **A citrulline intake of about 3 grams daily**, split over at least two servings, appears to provide effective support for the body’s NO synthase activity.

Exercise Training. When you do aerobic exercise, the increased rate of blood flow over the endothelial lining of your blood vessels exerts a “shear stress” on this endothelium that boosts its expression and activity of NO synthase; that’s a key reason why regular aerobic training reduces risk for heart attack and stroke.^{50,51} Exercise, done in the right way (in fasting metabolism), can also help to keep you lean or get leaner – overweight is an important risk factor for stroke. Most authorities recommend an aerobic exercise program that entails **exercising 3-5 times weekly for 30-60 minutes per session**. For people who are not in stellar shape, brisk walking is a very good exercise, and has the merit that it is not likely to injure your joints. Other smart aerobic activities which you can do in a gym include walking or jogging on a treadmill, stair climbing, cycling, and elliptical gliding.

Control Hypertension and Obesity. Hypertension greatly increases stroke risk, in part because elevated blood pressure has an adverse effect on vascular oxidative stress and NO activity.⁵² It can also increase risk for hemorrhagic stroke by putting pressure on fragile blood vessels. So you should **work with your doctor** to insure that your blood pressure is kept under good control. In addition to the anti-hypertensive medications which your doctor prescribes, **a diet rich in potassium and moderate in sodium** can aid blood pressure control in many people, as can **regular exercise**. Another thing you can do to moderate your blood pressure is to stay reasonably lean – or get leaner. Obesity and the metabolic syndrome linked to it (the so-called “metabolic syndrome”) is a risk factor for stroke, independent of its impact on blood pressure.^{53,54} There are many dietary strategies that can help people get lean and stay lean – a **whole-food low-fat plant-based diet**,⁵⁵ and/or the **“carb concentration” strategy**^{56,57} recommended on this website, are among the best sustainable approaches to weight control. And effective integration of

exercise with eating, so that fat is burned efficiently during and after exercise – the “**mini-fast with exercise**”⁵⁸ approach described on this website – can also be quite helpful for achieving leanness.

Statin Therapy. Elevated LDL cholesterol is not as closely associated with risk for stroke as it is with risk for heart attack, possibly because it has relatively little influence on the strokes that arise in small vessels of the brain.⁵⁹ Indeed, stroke can be common problem in certain high-salt Third World societies in which LDL cholesterol and heart attack risk are relatively low.⁶⁰ Nonetheless, reduction of LDL cholesterol using statin drugs tends to decrease risk for stroke, and to improve stroke outcome in people who have strokes.^{59, 61} In part, this may reflect the ability of statins to increase the level of NO synthase in vascular endothelial cells.³ Hence, use of statins or red yeast rice (containing natural statins⁶²) may lower your stroke risk if your LDL cholesterol is on the high side. LDL cholesterol can also be reduced with a plant-based or Mediterranean diet. As a cautionary note, a low level of serum cholesterol in people who are hypertensive increases risk for hemorrhagic stroke, so if your cholesterol is naturally low, it is particularly smart to keep your blood pressure in good control.⁶³

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