LE Magazine December 2006

REPORT

Vitamin C and Dihydroquercetin

Creating a More Potent Vitamin C

By Mark J. Neveu, PhD

Free radicals (black stream, bottom left to center right) damaging cellular DNA (white, center right). The DNA has originated from the cell nucleus (purple, lower right) and a sectioned cell membrane surrounds it. Vitamin C (blue particles) reduces this damage. LDL particles (orange) are oxidized by free radicals, and protected by vitamin E (yellow hexagons). Oxidized LDL is removed by white blood cells (pink/grey, upper center). These LDL-filled cells form atherosclerotic plaque (brown, upper right).

Every day, our bodies are under continual assault by damaging agents known as free radicals. Generally, both internal and dietary antioxidants do an excellent job of keeping free radicals in check. However, once this balance is disrupted, lethal diseases such as cancer, heart disease, lung disease, diabetes, Parkinson's disease, arthritis, Alzheimer's disease, and stroke can be initiated.[1-3]

A wealth of scientific evidence has repeatedly demonstrated that specialized compounds in fresh fruits and vegetables exert critical protection against free-radical assault.[4] Of these, vitamin C and plant substances known as flavonoids may be among nature's most potent natural antioxidants.[1-6]

Exciting new studies suggest that a flavonoid called dihydroquercetin, in combination with vitamin C, provides even more powerful, synergistic protection against oxidative stress than either substance alone.

FLAVONOIDS: NATURE'S "BIOLOGICAL RESPONSE MODIFIERS"

Scientists have recently begun to attribute many of the beneficial effects of fruits, vegetables, tea, and even red wine to the flavonoid compounds they contain.[5,6]

Flavonoids perform two important functions in the body. First, they strengthen the body's immune response to attacks from allergens, viruses, and carcinogens. Second, they act as powerful antioxidants, protecting the body against the oxidative stress and free-radical damage that underlie many cardiovascular, neurological, and diabetic diseases. Studies have shown that those who have increased flavonoid intake clearly demonstrate a decreased incidence and mortality of heart disease.[7-10]

One of the most important attributes of these flavonoids is their ability to enhance the effects of vitamin C. Vitamin C's main function in humans is to reduce the dangerous effects of oxidative reactions throughout the body. Unfortunately, because vitamin C is water soluble, it stays in the body for only a very brief time before being excreted. This time frame limits vitamin C's efficacy.[10] Until now, it has been recommended that vitamin C be taken in several doses to maintain optimal benefits. However, flavonoids have been shown to improve the concentration and efficacy of vitamin C throughout the body. This important finding means that you can take less vitamin C while it lasts longer and works harder.[11]

DIHYDROQUERCETIN

One flavonoid, dihydroquercetin, has been found to be extremely beneficial in helping vitamin C re-circulate throughout the body. Additionally, it limits the inactivation or oxidation of vitamin C, which enables vitamin C to last longer in the body.[12,13]

The addition of this unique flavonoid creates an entirely new way to deliver vitamin C to cells in need of its protection. Now, supplement users can maximize their benefits from longer-lasting and more effective vitamin C.

DIHYDROQUERCETIN FIGHTS CARDIOVASCULAR DISEASE

Dihydroquercetin acts in several ways to help avert cardiovascular disease.

Scientists have demonstrated that dihydroquercetin inhibits lipid peroxidation, a process that often leads to atherosclerosis.[14,24,32] In an animal study, dihydroquercetin inhibited the peroxidation of serum and liver lipids following exposure to toxic ionizing radiation.[33] Dihydroquercetin's inhibitory effects on lipid peroxidation are enhanced by both vitamin C and vitamin E.[34] By inhibiting the oxidation of harmful low-density lipoprotein (LDL), dihydroquercetin may help prevent atherosclerosis.[35]

Lowering high levels of low-density lipoprotein (LDL) is one the the major goals of anti-cholesterol or statin therapy as used by mainstream physicians. Studies suggest that dihydroquercetin may be helpful in therapeutic efforts to lower LDL by inhibiting the formation of apolipoprotein B, one of the primary components of LDL.[36]

Other studies have shown that dihydroquercetin lowers serum and liver lipid and cholesterol concentrations in rats.[37] A conjugated form of dihydroquercetin known as astilbin inhibits the same enzyme targeted by popular cholesterol-lowering statin drugs such as Lipitor®, Zocor®, and Pravachol®.[38]

Attacking heart disease from another angle, animal studies showed that dihydroquercetin lowers high blood pressure and normalizes an electrical measure associated with activation of the heart's pumping chambers (ventricles).[39]

SYNERGISTIC EFFECTS OF VITAMIN C AND DIHYDROQUERCETIN

Unlike plants and most animals, humans cannot manufacture vitamin C within the body and therefore must obtain it from external sources. This has led some scientists, including the late Nobel Prize-winning chemist Linus Pauling, to propose that humans would enjoy better health if they supplemented their diets with an amount of the nutrient proportional to the amount produced in animal species that manufacture their own vitamin C. Moreover, aging adults experience a decrease in vitamin C levels, which may contribute to the development of several degenerative diseases, such as cardiovascular disease, cancer, neurodegenerative conditions, and eye disorders.[14-16]

The combination of vitamin C and dihydroquercetin offers such tremendous promise in preserving and restoring health that it has been approved as a prescription drug in some parts of the world.

VITAMIN C AND DIHYDROQUERCETIN: WHAT YOU NEED TO KNOW

- A novel bioflavonoid, dihydroquercetin, offers exceptional benefits by enhancing the health-promoting benefits of vitamin C. Dihydroquercetin enhances the effectiveness of vitamin C by extending its period of bioactivity, enhancing its regeneration, and slowing its elimination from the body.
- Dihydroquercetin offers protection against cardiovascular disease by inhibiting several steps in the disease process. Additionally, dihydroquercetin helps guard nervous system health, prevents the complications of dia-betes, protects the liver against hepatitis-inducing agents, fights infection, and quells inflammation that can lead to dermatitis, arthritis, and pain.
- Some of vitamin C's best-known applications are preventing viral infection, enhancing cancer protection, and averting cardiovascular disease and stroke.
- In some parts of the world, a combination of vitamin C and dihydroquercetin is available as a prescription drug known as Ascovertin. Physicians utilize Ascovertin to manage health conditions that share oxidative stress as an underlying mechanism. Ascovertin has demonstrated efficacy in protecting against stroke, heart attack, and light-induced damage to the eye.
- Consumers in the United States can use the benefits of a dietary supplement combining dihydroquercetin and vitamin C without a prescription.

In Russia, a drug known as Ascovertin (a complex of dihydroquercetin and vitamin C) is a popular treatment for many health conditions that share oxidative stress as an underlying mechanism. Since oxidative stress characterizes many of the degenerative conditions associated with aging,[1-3] Ascovertin's potential applications are quite broad.

For example, Ascovertin may have applications in the management of stroke, a crippling, often fatal condition marked by a diminished supply of blood and oxygen to the brain. Studies of the effects of oxygen deprivation in rat brains demonstrated that Ascovertin decreased the damage caused by lack of blood flow. Additionally, Ascovertin restored normal structure and electrochemical activity to nerve synapses, the junctions that allow nerve cells to transmit information.[17,18]

The Russian Academy of Medical Sciences recently conducted two clinical studies of Ascovertin in 52 patients with impaired

blood flow to the brain. Ascovertin was administered for 21 days. The resulting decrease in blood viscosity and blood-clotting tendency improved attention, memory, and mental performance, relieved vertigo, normalized sleep, relieved headaches, and decreased fatigue.[19,20] No such changes were observed in the age-matched control patients.

COMMON APPLICATIONS OF VITAMIN C

Long considered essential to optimal health, vitamin C may offer targeted protection against viral infections, cancer, cardiovascular disease, and stroke.

- **Viruses.** Vitamin C is widely used to support the immune system's protection against colds and flus. In adults and children, the preventive use of vitamin C reduced the duration of colds by up to 14%.64 In athletes and soldiers, daily vitamin C intake reduced the incidence of colds by 50%. A recent study found mice that were deficient in vitamin C experienced increased lung tissue damage following infection with the influenza virus. Vitamin C-deficient mice also demonstrated increased expression of pro-inflammatory cytokines. These findings suggest that vitamin C is required for an effective immune response to infection with the influenza virus.[65]
- **Cancer.** Vitamin C may offer essential aid in fighting cancer. Higher intakes of vitamin C are associated with a decreased incidence of cancers of the mouth, throat, esophagus, stomach, colon, and lung.[64] In 2005, research by the National Institutes of Health found that vitamin C administered intravenously helped kill several strains of cancer cells. This led scientists to note that intravenous vitamin C may be an important tool in fighting cancer, which supports similar findings by Linus Pauling.[66] Furthermore, a recent clinical trial documented the safety of high-dose vitamin C in advanced cancer patients.[67] Several recent studies indicate that the combination of lysine and proline with vitamin C more effectively inhibits cancer cells than vitamin C alone.[68-79]
- **Cardiovascular Disease and Stroke.** Studies indicate that low or deficient intake of vitamin C is associated with an increased risk of cardiovascular disease. Similarly, the risk of death from cardiovacular diseases was found to be 25-42% lower in adults who consumed plentiful amounts of vitamin C through diet and supplements compared to adults who were deficient in vitamin C. Some research suggests that vitamin C supplements are more protective than dietary vitamin C in protecting against heart disease. Higher serum levels of vitamin C have been found to diminish the risk of suffering a stroke by up to 29%. Daily supplementation with vitamin C reduces high blood pressure, a contributor to cardiovascular and stroke risk.[64]

Ascovertin may also protect against some of the damaging consequences of heart attack. Studies in rats showed that Ascovertin inhibits the blood clotting and brain damage that can occur following a heart attack.[21,22]

The tissues of the eye may benefit from Ascovertin as well. Studies in rats found that Ascovertin inhibits damage to the eye's retina induced by high-intensity light.[23]

DIHYDROQUERCETIN SUPPORTS NERVOUS SYSTEM HEALTH

The brain and nervous system are particularly sensitive to the damaging effects of free radicals. As we age, free-radical damage can accumulate in the brain, leading to cognitive decline and other illnesses such as dementia and Alzheimer's. Maintaining optimal mental function is one of the leading goals of aging baby boomers. Fortunately, dihydroquercetin offers essential protection to critical brain and nerve cells.

To examine methods to protect the brain against injury, scientists used an animal model of stroke. Dihydroquercetin inhibited the expression of enzymes that lead to inflammation. Additionally, dihydroquercetin helped prevent inflammatory white blood cells from attacking and adhering to vulnerable areas of the brain. These actions help provide essential neuroprotection against the free-radical-induced oxidative damage that often occurs when the brain does not receive enough blood and oxygen.[27,28,40]

In addition to the cognitive decline that often accompanies aging, critical functions such perception, thinking, language, and consciousness can be adversely affected. Protecting the areas of the brain that oversee these functions is another important benefit of dihydroquercetin. In one study, researchers found dihydroquercetin prevented free radicals from causing oxidative damage to crucial nerve cells that oversee these functions.[41]

By protecting the cells of the brain and central nervous system, dihydroquercetin may help avert some of the most devastating changes associated with aging.

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DIHYDROQUERCETIN INHIBITS OXIDATIVE STRESS AND INFLAMMATION

Because of its forceful antioxidant abilities, dihydroquercetin can search for and destroy two of the most dangerous types of free radicals in the body: the superoxide and peroxide radicals. Dihydroquercetin also works overtime to protect red and white blood cells. Studies show that it protects white blood cells from environmental injury and prevents oxidative cell death in red blood cells. The result is a stronger, more vigorous immune system that can aggressively police and protect critical cell units throughout the body.[24-26]

DIHYDROQUERCETIN AVERTS COMPLICATIONS OF DIABETES

One of the most dreaded of diseases, diabetes has particularly damaging consequences for the cardiovascular system and the eyes. Dihydroquercetin may offer much-needed support for people who are trying to manage or reverse the effects of type II diabetes.

Scientists have noted that people with type II diabetes are at higher risk for arterial disease. This is partly because type II diabetes increases the capacity of certain white blood cells called neutrophils to adhere to the blood vessel lining, or endothelium.[42] This may contribute to vascular disease throughout the body, particularly in the essential blood vessels of the heart. A Russian study found that dihydroquercetin inhibits the pro-inflammatory activity of neutrophils in patients with type II diabetes,[43] and thus may help protect the vascular system against the damaging effects of the disease.

In diabetics, dihydroquercetin has been found to protect against two common causes of vision loss: macular degeneration and cataract. Macular degeneration occurs when an area of the eye's retina that is responsible for detailed vision begins to deteriorate. Dihydroquercetin promotes blood flow to this region of the eye, which offers protection against vision loss. Also, by inhibiting the activity of an enzyme in the eye lens, dihydroquercetin may help to prevent cataract formation in diabetic patients.[44,45]

As Life Extension readers know, inflammation is a key culprit in degenerative diseases such as arthritis, cardiovascular disease, and cancer. Dihydroquercetin has shown its ability to reduce inflammation-producing enzymes such as cyclooxygenase-2 (COX-2) and to inhibit inflammatory mediators, including cytokines.[27-30] The COX-2 enzyme has been the focus of extensive pharmaceutical research that has produced drugs such as Vioxx® and Celebrex®. These drugs went on to be implicated in the creation of lethal heart disease. Dihydroquercetin may provide a safe alternative to certain pharmaceuticals used to address inflammation.

Inflammation also makes its presence known through allergic reactions. Histamines are widely recognized as the trigger of most allergic episodes. Dihydroquercetin suppresses the release of histamines, thereby reducing the severity of allergic occurrences.[31]

DIHYDROQUERCETIN PROTECTS AGAINST LIVER DAMAGE AND HEPATITIS

Many chemicals used for industrial and commercial purposes—such as dioxins, dibenzofurans, and carbon tetrachloride—act like poisons in the liver. Some can induce liver toxicity and hepatitis by promoting the peroxidation of lipids.[46] Through its powerful antioxidant effects, dihydroquercetin may protect the liver against both toxic exposure and viral infection. When rats were supplemented with dihydroquercetin for four days before being exposed to a chemical formerly used in the dry cleaning and refrigeration industries, they were protected against the toxin's hepatitis-inducing effects.[47]

Moreover, in a mouse model of liver injury, dihydroquercetin was more effective than vitamin E in inhibiting the biochemical changes that can lead to hepatitis. Specifically, dihydroquercetin blocked production of pro-inflammatory tumor necrosis factor-alpha as well as the infiltration of immune system cells.[48-50]

Dihydroquercetin also shows promise in fighting virally induced hepatitis A. The hepatitis A virus is typically contracted through eating unsanitary food. In the laboratory, dihydroquercetin inhibited the replication and pathogenic effects of the hepatitis A

virus.[51]

Supplementation with dihydroquercetin thus offers important benefits for the liver by helping to protect against the damaging effects of exposure to toxins and viral hepatitis infection.

STUDIES CONFIRM SAFETY AND EFFICACY

Studies indicate that dihydroquercetin is highly safe and efficacious. In fact, research suggests that dihydroquercetin is even safer than its nutritional cousin, quercetin.[61,62] No toxic effects were observed in rats that were treated with high levels of dihydroquercetin for long periods of time.[63]

DIHYDROQUERCETIN ALLEVIATES ARTHRITIS PAIN, INFLAMMATION

The most common types of arthritis result from either inflammation-induced deterioration of the cartilage in joints (osteoarthritis) or the body's autoimmune attack against its own joint tissues (rheumatoid arthritis). Dihydroquercetin may offer benefits for both types of arthritis.[52,53]

One of the important ways in which dihydroquercetin may limit the onset of arthritis is by blocking the expression of inflammatory biochemicals. This action has been shown to avert the development of autoimmune-induced arthritis.[53] Additionally, dihydroquercetin inhibits the formation of activated immune cells, which could be effective in treating a variety of autoimmune disorders, including rheumatoid arthritis.[31,54]

Furthermore, dihydroquercetin may offer natural pain relief. In a study in mice, dihydroquercetin was more potent than aspirin or acetaminophen (Tylenol®) in inhibiting pain and inflammation.[55]

Dihydroquercetin may thus hold promise in averting the inflammation and autoimmune activity that contribute to arthritis. In existing instances of pain and inflammation, dihydroquercetin may offer natural relief from the discomfort of arthritis.

CONCLUSION

While people in Russia require a prescription to acquire the many benefits of dihydroquercetin and vitamin C, this broad-spectrum nutrient combination is now readily available as a low-cost dietary supplement to Americans seeking to enhance their health and well-being. By protecting and enhancing vitamin C as it courses through the body, dihydroquercetin dramatically increases the benefits of this important nutrient.

DIHYDROQUERCETIN PROVIDES IMMUNE SUPPORT

Exciting studies indicate that dihydroquercetin may support the fight against two types of serious infection: pneumonia and HIV.

Investigators examined dihydroquercetin's effects in patients suffering from acute pneumonia. When individuals undergoing standard therapy supplemented with an antioxidant formula featuring dihydroquercetin, they recovered faster from symptoms of lung inflammation compared to patients who underwent traditional therapy alone.[56]

Preliminary studies may suggest a role for dihydroquercetin in fighting the HIV virus. Dihydroquercetin was recently isolated as the active component in the stem bark of Chinese walnut, a plant extract that selectively kills cells infected with the human immunodeficiency virus.[57] Moreover, dihydroquercetin was found to inhibit the activity of an enzyme that viruses such as HIV use to replicate their genetic material.[58]

Substantial scientific evidence suggests that this novel combination of nutrients confers powerful, synergistic protection against some of the most common and dangerous diseases of aging, including cardiovascular, neurological, and diabetic disorders. Incorporating vitamin C and dihydroquercetin in a daily supplementation program is a simple, low-cost way to further strengthen the body's natural antioxidant defenses.

DIHYDROQUERCETIN SOOTHES IRRITATED SKIN

In a human study of skin inflammation, dihydroquercetin blocked various biochemicals that contribute to dermatitis.[29] Dihydroquercetin alleviates skin inflammation by stimulating a powerful, anti-inflammatory cytokine molecule known as IL-

10.[59,60] IL-10 helps reduce the skin's hypersensitivity reactions to external agents, an all-too-common cause of dermatitis.

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