

## BERRY FACT SHEET FOR HEALTH PROFESSIONALS/HEALTH MEDIA

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For years, health agencies have encouraged Americans to include greater amounts of fruits and vegetables in their diet to benefit from their tremendous disease fighting qualities. Epidemiological studies have always shown a clear association of a high fruit and vegetable diet and lower risk for chronic diseases such as cancer, heart disease, stroke and maybe even mental aging and Alzheimer's disease.

The National Cancer Institute, went from its catchy campaign of "5 A Day" in 1991 to its new slogan of "5 to 9 and feeling fine, fruits and vegetables anytime" in 2002. This increase in recommended servings of fruits and vegetables is the result of recent research on their additional benefits.

Specific fruits and vegetables have been showcased as superior health protectors. Brightly colored berries are edible superstars that may protect against certain cancers, heart disease and aging. Berries have been given this high status because of the vitamins, minerals, dietary fiber and phytochemicals that they contain.

### I. PHYTOCHEMICALS

Phytochemicals are nonnutritive substances in plants that promote health and prevent chronic disease. These are important chemicals obtained from the whole plant rather than its extracted individual nutrients in a vitamin or supplement pill. A major group of phytochemicals are antioxidants. Subgroups of antioxidants include flavonoids and ellagic acid. Flavonoids include quercetin and anthocyanins.

#### A. ANTIOXIDANTS

Antioxidants are the armor that neutralize free radicals. Exposure to our environment causes our bodies to form free radicals. They are unstable molecules and can attack any cell in the body in an effort to become stable. A free radical attack is called oxidation because it reacts with oxygen. Antioxidants (against oxygen or oxidation) neutralize free radicals thus preventing or delaying the cell damage.

When free radicals attack the cell membrane, it starts the development of atherosclerosis. When they attack the DNA in the cells it initiates mutagenic lesions and the formation of

cancer. Consumption of the more concentrated sources of antioxidants such as berries will have the greatest impact on antioxidant fighting capacity in the body.

Blackberries, raspberries and strawberries are all good sources of antioxidants and potent free radical scavengers. There are many forms of free radicals and each will react differently in the presence of the various antioxidants. A study was done on the effectiveness of berries against four types of reactive free radicals. These were singlet oxygen, hydrogen peroxide, hydroxyl radical and superoxide radical. Strawberries had the highest antioxidant activity against the free radical singlet oxygen and blackberries were the leader of the pack against the other three.

Oxygen Radical Antioxidant Capacity (ORAC) is a test tube analysis that measures the total antioxidant score of foods. Foods with the highest ORAC may give the body's cells the greatest protection.

The four berries topped the ORAC chart for 10 fresh fruits tested. Blueberries, blackberries, strawberries and raspberries showed superior ORAC values over plums, oranges, grapes, cherries, kiwi and grapefruit. Blueberries and blackberries even beat the top ORAC vegetable; kale and strawberries beat the second highest ORAC vegetable; spinach. All four berries won over the eight other vegetables tested for ORAC value showing their superiority in antioxidant fighting abilities.

## ANTIOXIDANTS AND AGING

Our bodies show signs of aging due to the amount of oxidation they experience. Aging may be the result of oxidation to the central nervous system. The oxygen radicals which can damage cell membranes and DNA are blamed for many dysfunctions and diseases associated with aging. Over time there will be an increase in age associated diseases which involve the nervous system such as Alzheimer's and Parkinson's disease.

Several studies suggest that foods can reduce the oxidation due to their antioxidant activity. Memory impairment and difficulties in concentration can be reduced with fruit and vegetables high in antioxidant activity.

James Joseph, Ph.D., lead scientist at the Laboratory of Neuroscience of the USDA Human Nutrition Research Center on Aging at Tufts University found astonishing results with spinach and berries. He found that diets supplemented with either spinach, strawberry or blueberry can prevent age induced declines in motor learning and memory in aged animals. All three supplements; blueberry, strawberry and spinach improved short term memory. Only the blueberry improved balance and coordination.

Age related declines in animals such as motor behavioral deficits have been shown by Dr. Joseph to be REVERSED but only with a blueberry supplemented diet. This is the first study that showed a food's ability to reverse dysfunction in behavior nerve cells.

## 1. FLAVONOIDS

Flavonoids are phytochemicals and strong antioxidants. The process of atherosclerosis is thought to be due to free radical damage. Flavonoids can destroy the two most dangerous types of free radicals and inhibit oxidation of lipids in the body; low density lipoprotein (LDL). They may be a natural anti-atherosclerotic component of the diet. As a heart disease safeguard, flavonoids can lower blood lipids such as cholesterol, protect the vascular system and prevent thrombosis.

### FLAVONOIDS AND HEART DISEASE

Studies suggest that flavonoid intake may reduce the risk of death from CHD in postmenopausal women.

In another study, the highest fruit and vegetable eaters were found to have a 31% lower risk of ischemic stroke. The women had almost 6 servings per day and the men about 5 servings. Each additional serving per day lowered their risk by 6%. The key components of fruits and vegetables that were responsible for lowered stroke risks were flavonoids, potassium, folate and fiber which berries have in high amounts.

The Dutch population was examined for their flavonoid intake and incidence of myocardial infarction, MI. The intake of dietary flavonoids from tea was inversely associated with fatal MI. In epidemiological studies, there is considerable evidence that tea drinking lowers the risk of heart disease. In animals, tea lowers blood cholesterol and other blood lipids; LDL and very low density lipoprotein, VLDL. Blueberries may have an equal or greater effect since they have a higher flavonoid content per kg. than tea.

A study of berry extracts showed protection against free radicals cell damage or oxidation. A low concentration of strawberries blocked the oxidation of human LDL cells by 54% and a higher concentration inhibited by 84%. Blackberries showed the most potent effects.

### FLAVONOIDS AND CANCER

Flavonoids, as effective antioxidants, may provide protection against cancer. They can inhibit various stages of tumor development in animals. The relationship between the intake of flavonoids and risk of cancer was studied among 9,959 Finnish men and women. An inverse relationship was observed between the intake of flavonoids and incidences of all cancer. The major food source of flavonoids in the Finnish diet was apples. It is interesting to note that blueberries contain more flavonoids per kg. than apples.

A natural flavonoid, rutin, showed ulcer protecting effects against gastric lesions.

A subclass of flavonoids is called flavonols. Flavonols contain quercetin and kaempferol. Kaempferol is found only in strawberries. Quercetin is found in all berries and is one of the most abundant flavonoids.

## a. QUERCETIN

### QUERCETIN AND CANCER

Quercetin is associated with protection against lung cancer in a Finnish study. In several in vitro studies on human cancer cells, quercetin protected the colon, breast, ovarian and gastrointestinal cells against cancer growth .

Quercetin may help in cell growth regulation and may protect against estrogen related cancers such as breast and endometrial cancers.

### QUERCETIN AND HEART DISEASE

Quercetin in human plasma demonstrates antiplatelet effects, preventing plaque from sticking to arteries, by inhibiting thromboxane formation or blood clotting. In a study of 552 men followed for 15 years, quercetin was inversely associated with stroke. Quercetin presents some pharmacological interest as an antithrombotic, anti-clotting, agent.

Additional benefits of quercetin on human health include protection against cataracts in diabetics, virus' and allergies.

The antioxidant function of quercetin was enhanced by vitamin C and even more potent was the combination of vitamin C and vitamin E. The availability of quercetin can be higher from foods than from purified compounds as in a supplement because of the synergism with the vitamins. The benefits of quercetin would be best derived from foods such as berries that contain the vitamin C and quercetin combination.

## b. ANTHOCYANINS

Anthocyanins are part of the flavonoid family. Procyanidins are the precursors of the blue violet and red pigments in plants such as blueberries, strawberries and blackberries. The pigment is where the disease fighters are found. Berries are characterized by their bright color and high anthocyanin content.

## ANTHOCYANINS AND AGING

Dr. Joseph showed that age related declines in animals could be reversed only with the blueberry supplement, even though the spinach diet had an equal amount of antioxidant activity. The spinach was ineffective in the reversal of aging. The blueberry extract is rich in anthocyanins but the spinach does not contain any. The difference may be in the protective factors of the flavonoid- anthocyanins. It may be the indigo pigments found in blueberries that are responsible for its benefits.

## ANTHOCYANINS AND HEART DISEASE, CANCER, ETC.

Anthocyanins are free radical scavengers and antioxidants. They battle against vascular disease, bacteria, virus', cancer, inflammation and allergies. Of all the antioxidants, anthocyanins show the most ability to penetrate cell membranes and provide protection.

They have pharmaceutical applications since they increase peripheral circulation, improve vision , enhance immune system and promote wound healing. Anthocyanin products are prescribed as medicines in many countries for treatment of various diseases.

## ANTHOCYANINS AND INFLAMMATION

Food sources of anthocyanins show promise in providing the same benefits. Anthocyanins found in raspberries and sweet cherries show anti-inflammatory activity. These fruits inhibit cyclooxygenase, an enzyme involved in inflammation. Strawberries, blackberries and cranberries were also moderately effective. Aspirin and other anti-inflammatory drugs inhibit the same enzymes. The salicylic acid in aspirin is found in berries. These fruits may be as effective as drugs in alleviating pain from arthritis and gout.

During storage, anthocyanins in strawberries, raspberries and blueberries actually increase. Strawberry anthocyanin content went up to 6.8 fold when stored at 30 degrees C for 8 days.

## 2. ELLAGIC ACID

### ELLAGIC ACID AND CANCER

Ellagic acid is another phytochemical that defends the body against cancer. Ellagic acid has been shown to impede cancers of the lung, skin and liver in animals.

Out of the 26 fruits and nuts that Dr. Stoner from Ohio State University tested for ellagic acid, raspberries, blackberries and strawberries were the top three.

Dr. Gary Stoner tested the ellagic acid in dehydrated strawberries in animal diets. The diet decreased the incidence of chemically induced tumors in the esophagus. Another study showed that esophagus cancer was also inhibited with freeze dried strawberries. Freeze dried raspberries have also shown to prevent cancer in animals. Dr. Stoner also found that freeze dried berries protected the colon against cancer.

Dr. Larcom, professor at Clemson University in South Carolina found that extracts of blueberry and blackberry can suppress breast cancer growth. Strawberry, blueberry and raspberry contain chemicals found to protect cultured cells against cervical and breast cancer. In vitro, blueberry was found to resist cervical and breast cancer. Phytochemicals from these berries significantly suppress cancer causing cell mutations.

Raspberries protected animals against cancer by interrupting the initiation, promotion and progression stages. They contain multiple compounds known to prevent cancer besides ellagic acid; calcium, vitamins C and E, folic acid, selenium and ferulic acid.

-Lisa Bellini Gergley, M.S., R.D.