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Executive Summary

The information presented draws on a thorough literature review of the science of raspberries prepared by Dr. Joe Powers of Washington State University, a scientific roundtable facilitated by the Washington Red Raspberry Commission in April of 2007, and subsequently published research.

There is a significant body of scientific data that supports numerous health benefits of consuming raspberries and a greater consumer interest in and appreciation for eating foods that promote health and wellness.

Chronic maladies associated with aging—including heart disease, cancer, cardiovascular disease, and cognitive decline—are adversely stimulated by oxygen damage (oxidative stress). Consumption of anti-oxidants provides significant protection against disease. Raspberries are a rich source of anti-oxidants, vitamins, and fiber; science proves that increased regular consumption of natural plant sources combined with exercise and calorie restriction improves wellness and vitality and reduces risk or improves recovery from serious chronic diseases.

Raspberries in view of their traditional nutrient and beneficial phytochemical composition have been shown to have the following health benefits:

1. Protect against free radical induced cell damage and reduce oxidative stress
2. Prevent the growth of cancer cells in vitro and in animal models
3. Reduce the risk of cardiovascular disease
4. Help regulate blood glucose and reduce the risk of diabetes
5. Provide protection against food induced allergic reactions
6. Protect against infectious bacterial diseases
7. Protect against viral diseases

The key nutritional attributes of raspberries are that this fruit is:

- Low in calories, 70 calories per 1 cup serving.
- Low fat (1 gram per 1 cup serving)
- High in fiber (provides 32% of USRDV)
- High in vitamin C (provides 50% of USRDV)
- 5% of USRDV of potassium
- 6% of USRDV of folate
- In the top 10 of high anti-oxidant fruits and vegetables
- Very high in polyphenols including anthocyanins
- A Major source of ellagic acid
- Cholesterol.free
- High in Magnesium

While each of these characteristics plays a more significant role in reduction of individual disease states (e.g. ellagic acid in cancer), there is widespread consensus in the scientific community that it is far more beneficial to consume the whole food as opposed to supplements because of the synergistic effect of all nutrients.

This paper addresses the health benefits of raspberry consumption as they pertain to cancer, aging & cognitive function, cardiovascular health, obesity, diabetes and weight management. It is important to note that there is agreement in the scientific community that most chronic illness and disease states are caused by inflammation. Preliminary research suggests that raspberries are a potent anti-inflammatory; this quality may very well be the common denominator for the scientific results across all categories of illness and disease. The anti-inflammatory properties of food are also increasingly appearing in consumer messages.

Cancer

The American Cancer Society recommends eating five to nine servings of fruits and vegetables a day for cancer prevention (ref), and raspberry consumption is certainly part of this general recommendation. Raspberries are also known as good sources of vitamin C and fiber. According to the American Institute for Cancer Research's second expert report, *Food, Nutrition, Physical Activity, and the Prevention of Cancer: A Global Perspective (2007)*, foods high in vitamin C probably protect against cancer of the esophagus, while foods containing dietary fiber can probably decrease one's risk of developing colorectal cancer.

Raspberries hold an additional promising benefit because of their high concentration of ellagic acid. Medical literature indicates that ellagic acid can potentially reduce the risk of developing cancer as well as slow down the progression of already formed tumors (ref). Considerable research has been undertaken on the relationship between ellagic acid and cancer. In laboratory studies, this phytochemical has shown the ability to prevent cancers of the skin (ref), bladder (ref), lung (ref), esophagus (ref) and breast (ref). Research suggests that ellagic acid seems to utilize several different cancer-fighting methods at once: it acts as an antioxidant, it helps the body deactivate specific carcinogens and it helps slow the reproduction of cancer cells (ref).

Ellagic acid is a phenolic compound known for its potent anticarcinogenic and anti-mutagenic properties (ref). Clinical tests conducted at the Hollings Cancer Institute at the Medical University of South Carolina and dozens of other prestigious research centers show that this naturally occurring plant phenol may be the most effective way to prevent cancer, to inhibit the growth of cancer cells, and to arrest the growth of cancer in people with a genetic predisposition for the disease (ref). Clinical studies also have found that ellagic acid in raspberries is easily absorbed by the body (ref).

Ellagic acid acts as a scavenger to "bind" cancer-causing chemicals, making them inactive (ref). It inhibits the ability of other chemicals to cause mutations in bacteria. In addition, it prevents binding of carcinogens to DNA and reduces the incidence of cancer in cultured human cells exposed to carcinogens (ref).

A review of the literature demonstrates:

- Eating only a cup of raspberries each day has been shown to prevent cancer cells from developing (ref). It may also kill some types of cancer, such as cells that have been infected by the human papilloma virus (HPV, the cause of cervical cancer.) (ref)
- Ellagitannins reduce the growth of abnormal cells within the colon (ref).
- Studies have shown that ellagitannins may also be effective for preventing cancer in the breasts, pancreas, colon, esophagus, skin and prostate glands (ref).
- Ellagitannins contained in red raspberries can also protect cells against cancer-causing chemicals which are contained in cigarettes, and food additives (ref).
- Ellagitannins help to stop other volatile chemicals that bring about bacterial mutations (ref).
- Raspberry ellagitannins are also able to protect and defend DNA by stopping carcinogens from connecting to it (ref).

A study in cell cultures found that ellagic acid may act against substances that allow tumors to form new blood vessels (ref). Raspberries are also rich in anthocyanins believed to play a role in cell repair and may decrease the risk of cancers, including those in the breast and gastrointestinal tract (ref).

Cardiovascular Health

General dietary advice for cardiovascular health involves a diet rich with fruits and vegetables and fiber (raspberries have high fiber content). It turns out that in addition to fitting into general preventive health guidelines, raspberries are superior to some fruits and vegetables because of their unique nutrient content. The positive health effects extend to benefits to the heart and blood vessels. A body of scientific studies suggests that consuming the anti-oxidants present in raspberries, especially anthocyanins and elergitannins, can reduce LDL oxidation.

Research on anthocyanins also shows that they reduce the coagulation of blood platelets, inhibiting formation of blood clots involved in stroke, pulmonary embolism, peripheral vascular disease and heart attack, promote higher levels of “good” cholesterol (HDL), and inhibit oxidation of “bad” cholesterol (LDL).

An emerging area for red raspberry consumption is its anti-inflammatory properties and its role as a COX-1 and COX-2 inhibitor. Aspirin or ibuprofen inhibits the enzyme that causes clotting. Raspberries also have an effect on clotting, suggesting a benefit of daily consumption of raspberries, “like a daily baby aspirin.” Recently published research from Michigan State University, East Lansing, investigated a range of fruits and berries for the level and activity of anthocyanins 1 and 2. These work in a similar manner to ibuprofen, helping the body block signals that cause pain and inflammation, stimulated by COX-1 and COX-2, forms of cyclooxygenase. Researchers discovered that the COX inhibitory activities of anthocyanins were comparable to those of ibuprofen and naproxen.

Raspberries contain salicylic acid believed to have protective effects similar to aspirin in preventing heart disease in those at high risk or who have heart disease. Salicylic acid is a natural phenolic compound known as the active principle of aspirin. A 100-gram serving (about 3 /4 cup) of red raspberries contains around 5 milligrams of salicylic acid. Salicylic acid may have the same effects as aspirin in protecting people from cancer and the progression of atherosclerosis.

Diets rich in magnesium have recently received greater attention. Magnesium is known to be important for the growth and health of bones, but more recent studies are pointing to its role in reducing the incidence of metabolic syndrome, a group of conditions that increases the risks of type 2 diabetes and heart disease, including heart attack and stroke.

Aging & Cognitive Function

The onset of age-related neurodegenerative diseases such as Alzheimer's or Parkinson's disease, superimposed on a declining nervous system, could exacerbate the motor and cognitive behavioral deficits that occur as a part of the aging process.

It is in the interest of public health to explore methods to slow down or reverse age-related neuronal deficits. Consumption of diets rich in antioxidants and anti-inflammatory polyphenolics, such as those found in vegetables and fruit, including raspberries, may lower the risk of developing age-related neurodegenerative diseases.

Research suggests that the polyphenolic compounds found in berry fruits may exert beneficial effects by lowering oxidative stress and inflammation or by altering the signaling involved in neuronal communication, calcium buffering ability, neuroprotective stress shock proteins, plasticity, and stress signaling pathways. These interventions, in turn, may exert protection against age-related deficits in cognitive and motor function.

Scientific evidence released by the Kame Project demonstrated that regular dark fruit juice consumption could lower risk against Alzheimer's disease. These findings suggest the potential anti-aging roles of berry phenolics including anthocyanins. Research is currently underway to determine whether or not raspberry consumption improves motor control, memory and learning of new tasks in mice and aged rats. If the findings are positive, this would suggest that the beneficial effects of anthocyanins are due not only to antioxidant protection against stress, but also to neurogenesis, enhanced neuronal signaling capabilities and improved communication among neurons.

Obesity, Weight Management, and Diabetes

Scientific research also has addressed raspberry consumption and obesity, weight management and diabetes. As a low calorie, high fiber food, raspberries have an important positive effect on satiety, the feeling of fullness, and consequently, can play a role in weight management by helping people to eat less food. Fiber helps reduce both hunger and the number of calories people's bodies can absorb.

Consumption of raspberries has also been revealed to help in blood sugar regulation. Ellagic acid as well as several other constituents in raspberries enhance insulin action, decrease insulin resistance and lower blood sugar, and have multiple anti-inflammatory effects and decrease oxidative stress as well as lower blood pressure.

New data also shows that ellagic acid is very effective in preventing damage to the eyes, kidneys, heart and the small capillaries of the feet and hands that occur with high glucose levels by inhibiting an enzyme called aldose reductase. This enzyme is responsible for the production of protein-sugar products called Advanced Glycation End-Products (AGE). These end products cause the damage of small blood vessels that leads to the blindness, kidney damage, stroke and heart attacks and loss of limbs associated with both forms of diabetes.

When given to mice in high doses, raspberry ketone has been shown to prevent high fat diet induced elevations in body weight. This effect comes from the alteration of lipid metabolism, increasing norepinephrine-induced lipolysis.*

**Products containing this compound are marketed for weight loss, but this effect has not yet been demonstrated in humans.*

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