The Montmorency Cherry Health and Nutrition Report

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Introduction

Researchers continue to explore the benefits of "superfruits" - a unique group of nutrient-rich fruits that contain natural compounds shown to have potential health-promoting properties.

Few fruits fall into this category and emerging science shows Montmorency cherries (Prunus Cerasus) are among them. Montmorency cherries, commonly found in juice, dried and powdered forms, are rich in antioxidants and contain potent, naturally-occurring phytonutrients, including anthocyanins and melatonin, which have been linked to a variety of health benefits.

Research suggests consumption of Montmorency cherries may help reduce inflammation and ease the pain of arthritis and gout; offer protection against heart disease and certain cancers; reduce the risk of diabetes and insulin resistance syndrome; help maintain healthy sleep patterns; maintain a healthy brain and cognitive function and speed recovery rates after intense training.
Antioxidants

Oxygen is an important component of the air we breathe. We couldn’t survive without it. But oxygen can also be a source of free radicals – unstable oxygen molecules associated with cancer, heart disease and the effects of ageing.

Luckily, antioxidants can counter, scavenge, and deactivate these damaging free radicals. Thousands of studies, spanning decades of research, consistently and repeatedly show that maintaining a high antioxidant defence system lowers a person’s risk for disease, stimulates the immune system, protects brain neurons from damage, and possibly even slows the ageing process.

Oxidative stress associated with disease occurs when oxidative damage exceeds our antioxidant defences. That antioxidant system depends on the food we eat. A lab testing procedure called Oxygen Radical Absorbance Capacity (ORAC), measures the total antioxidant capacity of foods. ORAC measures how many oxygen radicals a specific food can absorb and deactivate (Ou 2001).

The more oxygen radicals a food absorbs, the higher its ORAC score. The higher the ORAC score, the better a food may be in helping our bodies prevent diseases like cancer and heart disease. Nutrition experts estimate a person needs to consume 3,000 to 5,000 ORAC units a day to reach a significant antioxidant capacity in the blood associated with health benefits.

Research studies have shown Montmorency cherries contain a rich mix of compounds with strong antioxidant properties. Good quality Montmorency cherry products, made using techniques to protect their antioxidant compounds, can deliver very high ORAC values, which is why leading nutritionists recommend these products as part of a healthy diet.

Montmorency cherry concentrate, for example, has been shown to supply 5,000 - 8000 ORAC units per single serving (30ml), depending on the quality of the concentrate, which equates to an entire day’s recommendation.

Anthocyanins

Montmorency cherries are one of the richest sources of powerful compounds called anthocyanins, which provide the distinctive red colour and may hold the key to many of the benefits locked inside (Chandra 1992, Wang 1997, 1999). Studies suggest that these health-promoting pigments possess antioxidant, anti-inflammatory, anti-ageing and anti-carcinogenic properties (Blando 2004).
Anthocyanins that give Montmorency cherries their deep, rich colour belong to a large group of phenolic compounds called flavonoids. Of the 150 different flavonoids found in plants, anthocyanins appear to have the greatest antioxidant capacity (Elliott 1992).

Research conducted at Michigan State University found that Montmorency cherries contained the highest concentrations of anthocyanins 1 and 2 – which help block enzymes in the body called cyclooxygenase 1 and 2 (popularly known as COX-1 and COX-2) (Seeram and Momin et al. 2001). Some pain medication works by inhibiting COX-1 and COX-2, which may explain why some people find that Montmorency cherries help ease the pain of arthritis and gout.

The researchers found that Montmorency cherries were the richest source of these beneficial compounds compared to various berries, including raspberries, blackberries and strawberries. Anthocyanins 1 and 2 were not found in blueberries.

Montmorency cherries contain 30 to 40 milligrams of anthocyanins 1 and 2 in every 100 grams of fruit. Montmorency cherries contain significantly more anthocyanins and phenols than do sweet cherries. For example, one study found that the total phenolic content of sweet cherries ranged from 92 to 147 milligrams/100 grams, while the same amount of Montmorency cherries contained up to 312 milligrams, or more than twice the phenols (Kim 2005, Chandra 1992).

Anthocyanins are more effective than vitamin C, four times more potent as an antioxidant than the well-known vitamin E (Rice-Evans 1995), and have been compared to ibuprofen, aspirin, and naproxen for their anti-inflammatory action (Seeram 2001).

Numerous studies, including one from the Johns Hopkins Hospital in Baltimore concluded that anthocyanins in Montmorency cherries significantly lowered inflammation and pain in animals. The proposed mechanisms are due to anthocyanins’ anti-inflammatory and antioxidant properties, which lower oxidative stress following inflammatory insult (Tall 2004).

**Other Phenolic Compounds**

Additional studies identified other active phenolic compounds in Montmorency cherries including chlorogenic acid, ellagic acid, gallic acid, p-coumaric acid, perillyl alcohol (POH) and quercetin (Wang 1999) all of which are potent antioxidants.

Research conducted at Brunswick Laboratories in Wareham,
Massachusetts found that Montmorency cherries also contain a class of compounds that act like superoxide dismutase, a powerful enzyme and cellular antioxidant.

According to researchers at the University of California, ellagic acid is a potent antioxidant, anti-cancer, and anti-atherosclerotic compound (Seeram 2004). One study found that ellagic acid in fruit extracts reduced cancer cell proliferation in a dose-dependent fashion; that is, as ellagic acid increased, cancer cell growth decreased (Ross 2007).

P-coumaric acid is another phenolic compound that exhibits strong antioxidant activity (Kim 2005). An in vitro study of human leukaemia cells, found that p-coumaric acid, along with gallic acid and other phenols, enhanced cancer cell death (Dedoussis 2005).

**Melatonin/Sleep Patterns**

Montmorency cherries are one of the few known food sources of melatonin, a potent antioxidant that helps improve the body’s circadian rhythms and natural sleep patterns (Burkhardt 2001). A study conducted by Reiter and colleagues at the University of Texas Health Science Center found that Montmorency cherries contain substantial amounts of melatonin, at levels higher than normally found in human blood.

Montmorency cherries, which account for the majority of sour cherries produced in the U.S., contain 13.5 nanograms (ng) of melatonin per gram (Burkhardt 2001). Produced naturally by the body’s pineal gland at the apex of the brain, melatonin has been shown to do much more than regulate our sleep-wake cycle. Studies suggest that melatonin may help protect the vascular system, lessen inflammation, and reduce ischemia and reperfusion injury associated with surgery (Tan 2000, 2003, Cuzzocrea 2001, Lissoni 1997, Reiter 2001, 2000).

A study conducted by Reiter and researchers from St. Marianna University of School of Medicine in Japan found that feeding chicks a diet containing plants rich in melatonin raised blood levels of melatonin, indicating that melatonin ingested
from the diet is absorbed and enters the general circulation, after which it is capable of binding to sites in the brain and other tissues (Hattori 1995).

Reiter and colleagues speculate that eating just a handful of Montmorency cherries will increase melatonin levels in blood, thereby improving the body’s natural sleep patterns and potentially providing other health benefits.

**Joint Health/Arthritis and Gout**

For decades, Montmorency cherries have quietly grown a devoted fan base of arthritis sufferers who routinely consumed the fruit (particularly as juice) to help soothe their symptoms. At the time, the only evidence was anecdotal. Today, however, there appears to be science behind the cherry folklore.

The suspicion that cherries might help with arthritis and gout was first proposed in 1950 (Blau 1950). This preliminary study found that daily cherry consumption helped to relieve “gout attacks” and the pain associated with arthritis. After eating the cherries, the patients in the study had lower blood levels of uric acid. Elevated levels of uric acid are associated with the onset and progression of gout.

Since then, several studies have confirmed this link, including a study from USDA’s Human Nutrition Research Center at the University of California, Davis where researchers found that healthy women (ages 20 to 40 years) who consumed two servings or 280 grams of cherries after an overnight fast showed a 15 percent reduction in uric acid levels, as well as lowered nitric oxide and C-reactive protein levels (Jacob 2003).

The researchers conclude that “...compounds in cherries may inhibit inflammatory pathways” associated with gout.

Additional studies suggest that consumption of cherries may be beneficial for the management and prevention of inflammatory diseases (Kelley 2006, van Acker 1995), including inflammatory pain like osteoarthritis (Tall 2004).

Nitric oxide has also been implicated in both osteoarthritis and rheumatoid arthritis, while studies show that antioxidants scavenge this oxidant and
potentially aid in the treatment or prevention of symptoms (Bezerra 2004, Remans 2005).

**Heart Health**

Strong evidence indicates that diets rich in colourful fruits and vegetables may help lower heart-disease risk. Beyond the anti-inflammatory benefits, many of the phenolic compounds in Montmorency cherries may offer protection against heart disease and stroke.

The Zutphen Elderly Study is a longitudinal study on lifestyle and chronic diseases started in 1985 at the National Institute of Public Health and Environmental Protection in The Netherlands. It has produced a wealth of valuable information about diet and health. One published report from this study of 805 men (ages 65 to 84 years) who were followed for five years found that as flavonoid intake increased, the risk for coronary artery disease decreased. The relative risk for dying from heart disease was 58 percent lower in those men who consumed the most flavonoids compared to those men who consumed the least (Hertog 1993).

Oxidative damage is a major contributor to nitric oxide-mediated functions of the vascular system and in the initiation and progression of cardiovascular disease. In a study on pigs, researchers at Indiana University School of Medicine in Fort Wayne found that anthocyanins, when consumed in large amounts, enhanced vaso-relaxation.

Even small amounts protected arteries from oxidative damage (Bell 2006). Another study published in the Journal of Nutrition supports this effect and found that anthocyanins had a vaso-relaxant effect on rat arteries that might help reduce cardiovascular mortality (Andriambeloson 1998). Numerous other studies show that other phenolic compounds found in Montmorency cherries, such as quercetin, protect low density lipoproteins (LDL – the “bad” cholesterol) from oxidative damage, thus reducing their atherogenicity (Safari 2003).

Anthocyanins in Montmorency cherries also might lower blood lipids, thus reducing heart disease risk. In a study from the University of Michigan, varying amounts of whole Montmorency cherry powder were fed to rats for 90 days. Results showed that the cherry-enriched diets significantly lowered plasma triglyceride and total cholesterol, fasting glucose and insulin, and a plasma marker of oxidative damage, while slightly raising high-density lipoproteins (HDL - the “good” cholesterol) and significantly elevating blood antioxidant capacity. The cherry-enriched diets also reduced “fatty liver” or the accumulation of
triglyceride and cholesterol in the liver. (Seymour 2007).

Montmorency cherries also may lower inflammatory processes associated with heart disease. C-reactive protein (CRP) is a substance found in blood that is a marker for inflammation in the body. High levels of this protein are associated with an increased risk of heart disease and low levels with a low risk. The link between elevated CRP levels and heart disease has been demonstrated repeatedly, and there is evidence that CRP may be a more important indicator of heart disease risk than high LDL ("bad") cholesterol. In an eight-year study involving 27,939 women at Brigham and Women's Hospital in Boston, more than half of the women who eventually developed heart disease had high CRP levels even though their LDL levels were not considered high (Ridker 2000, 2002).

A study from the U.S. Department of Agriculture’s Human Nutrition Research Center at the University of California, Davis found that men and women who supplemented their diets with 280 grams of cherries for 28 days had a 25 percent reduction in CRP levels, suggesting reduced inflammation associated with atherosclerosis risk (Kelley 2006).

**Brain Health**

The brain is particularly susceptible to oxidative damage, since it accounts for about 20 percent of the total body’s oxygen consumption, but it is only about 2 percent of the body’s weight. Numerous studies show that the phytonutrients in Montmorency cherries aid in protecting neurons in the brain from oxidative damage associated with neuronal loss.

Researchers at USDA’s Human Nutrition Research Center on Ageing at Tufts University in Boston state that there is “...ample research [that] indicates age-related neuronal-behavioural decrements are the result of oxidative stress that may be ameliorated by antioxidants” (Joseph 1999). This oxidative damage has been linked to a higher risk for memory loss, dementia, and even Alzheimer’s disease, while antioxidant-rich phytonutrients, such as the phenols, help reverse the course of neuronal and behavioural ageing, and possibly improve memory (Gailli 2002, Joseph 1996, Andres-Lacueva 2005, Shukitt-Hale 2006, Lau 2005).

In a study from Korea, cherry phenolics protected brain neurons from oxidative damage in a dose-dependent fashion, primarily due to the amount of anthocyanins in the fruit (Kim 2005).
Another study investigated the effects of anthocyanins on cerebral ischemic injury (stroke) in rats. Results showed that rats fed anthocyanins had significantly less damage to brain tissue from reduced blood supply caused by stroke. The researchers concluded that “...consumption of anthocyanins may have the possibility of a protective effect against neurological disorders, such as brain ischemia” (Shin 2006).

An animal study from Spain found that anthocyanins were able to cross the blood brain barrier and localize in various brain regions important for learning and memory (Andres-Lacueva). Researchers at Tufts University conclude that anthocyanins show the most efficacy in penetrating the cell membrane and in providing antioxidant protection (Galli 2002).

**Cancer Risk Reduction**

Researchers believe Montmorency cherries may have the potential to reduce the risk of colon cancer because of anthocyanins and cyanidin, another type of flavonoid found in cherries.

Researchers at Michigan State University tested the potential anticancer effects of Montmorency cherries in mice and human colon cancer cell lines (Kang 2003). In the study on mice, a diet containing cherries produced significantly fewer tumours compared to mice fed control diets.

In the second study on human colon cancer cells, anthocyanins and cyanidin reduced cell growth. The researchers concluded that “...Tart cherry anthocyanins and cyanidin may reduce the risk of colon cancer.”

A review of the research published in the Journal of Biomedicine and Biotechnology concluded that anthocyanins in tart cherries may help inhibit tumour development and growth of human colon cancer cells (Blando 2004).

Montmorency cherries are rich in another phytonutrient called perillyl alcohol (POH), which is a member of the monoterpenes family, along with limonenes. Numerous studies indicate that POH may help prevent the formation and progression of
certain cancers. How POH inhibits the growth of cancer is under investigation. Evidence suggests it helps rid the body of carcinogenic chemicals or interferes with signals that cause cells to divide rapidly.

**Blood Sugar Control/Diabetes**

Montmorency cherries and their compounds appear to aid in diabetes control and in reducing the complications associated with this disease. In a study from Michigan State University, partially funded by the U.S. Department of Agriculture, the effects of extracts of anthocyanins from Montmorency cherries were tested on mouse pancreatic cells, which produce the hormone insulin in the presence of glucose (sugar). Results showed that anthocyanin-exposed cells increased insulin production by 50 percent compared to cells not exposed to anthocyanins. The researchers conclude that cherries might be useful in the prevention of type 2 diabetes (Jayaprakasam 2005).

In another study, a single dose of anthocyanins decreased fasting blood glucose levels by 19 percent and improved glucose tolerance by 29 percent. After one month of treatment with anthocyanins, fasting blood glucose levels had dropped to half of the pre-treatment levels and glucose tolerance had improved by up to 41 percent (Cherian 1992).

Small blood vessels, called capillaries, are damaged in diabetes as a result of elevated blood sugar levels. Collagen proteins become linked to the elevated sugar and form abnormal complexes that damage tissues and blood vessels. One study found that anthocyanins significantly reduced the formation of these abnormal protein complexes (Cohen-Boulakia 2000).

Retinopathy is a serious complication of diabetes, resulting from the overproduction of abnormal proteins produced when the body attempts to repair damaged capillaries. Anthocyanins appear to prevent this damage to blood vessels and also might prevent production of abnormal proteins. In one study, this damage was significantly reduced in 12 diabetic patients who consumed 600 milligrams of anthocyanins a day for two months (Boniface 1996).
In another study, 31 patients with diabetic retinopathy showed marked improvement in permeability and a reduced tendency to haemorrhage when treated with anthocyanins (Scharrer 1981).

Studies have shown that Montmorency cherries have a low glycemic index (GI) score of 54, thus producing only a mild rise in blood sugar levels associated with lowered risks for diabetes and weight gain.

**Immune Health**

A German study (Bub 2003) demonstrated how consumption of polyphenol-rich juices reduced oxidative DNA damage and stimulated immune cell function. Lymphocyte proliferative responsiveness, Interleukin-2 secretion by activated lymphocytes and the lytic activity of natural killer cells were significantly increased.

**Muscle Soreness and Recovery**

Emerging studies by US and UK sports science researchers demonstrate how consumption of Montmorency cherry juice can reduce post-exercise muscle soreness and speed recovery of muscle function after strenuous bouts of training.

A study performed at the Human Performance Laboratory, University of Vermont (Conolly 2006) demonstrated how drinking a Montmorency cherry juice blend decreased some of the symptoms of exercise induced muscle damage.

Another study at London South Bank University (Bowtell JL) demonstrated how elite athletes taking Montmorency cherry juice before and after a strenuous bout of exercise, significantly improved their recovery rates of muscle function, with a strong tendency for reduced muscle soreness.

A further two studies (Howatson 2009 and Kuehl 2010) showed significantly less inflammation and soreness in long distance runners who had consumed a Montmorency cherry juice than the placebo control group.
References


DA J, Connolly P, M McGHugh and O Padilla-Zakour. Efficacy of a cherry juice blend in preventing the symptoms of muscle damage. Human Performance Laboratory, University of Limerick.


The Montmorency Cherry Health and Nutrition Report is a summary of the potential benefits of regular consumption of products containing Montmorency cherries and their compounds. This report has been commissioned by the Cherry Marketing Institute, USA.

The intent of the report is to provide an overview of the scientific evidence and potential benefits of Montmorency cherry consumption, not to provide individual recommendations. The information is not intended to prevent, diagnose, treat or cure disease but to help health professionals promote good health, as part of a healthy diet and active lifestyle.

Technical review of the contents of this report was provided by Russel Reiter, PhD. Department of Cellular and Structural Biology, University of Texas Health Science Center, USA.

The Montmorency Cherry Health and Nutrition Report has been commissioned by The Cherry Marketing Institute, USA. Disclaimer: This report is for information purposes and for professional use only. It is not intended to provide individual recommendations, nor intended to prevent, diagnose, treat or cure any disease.