

# [Tart cherries contain powerful antioxidants biology essay](https://assignbuster.com/tart-cherries-contain-powerful-antioxidants-biology-essay/)

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may hold the key to the benefits locked inside (Chandra 1992, Wang 1997, 1999). Studies suggest that thesedisease-fighting pigments possess antioxidant, anti-inflammatory, anti-aging and anti-carcinogenic properties(Blando 2004). Tart cherries are one of the richest sources of anthocyanins. The unique health benefits of cherries first came to light in the 1990s, when numerous studies were publisheddescribing the antioxidant content of this fruit. Spurred by what was then anecdotal evidence that cherriesalleviated the pain of arthritis and gout, researchers discovered that cherries had high antioxidant activity. Additional studies identified the active antioxidants as eight polyphenolic compounds, including anthocyanins, chlorogenic acid, gallic acid, p-coumaric acid, and quercetin (Wang 1999). Research conducted at Brunswick Laboratories in Wareham, Massachusetts, found that tart cherries containa class of compounds that act like superoxide dismutase (SOD), a powerful enzyme and cellular antioxidant. ANTHOCYANINSAnthocyanins that give tart cherries their deep, rich color belong to a large group of phenolic compounds calledflavonoids. Of the 150 different flavonoids found in plants, anthocyanins appear to have the greatest antioxidantcapacity (Elliott 1992). Research conducted at Michigan State University found that tart cherries contained the highest concentrationsof anthocyanins 1 and 2 – which help block enzymes in the body called cyclooxygenase 1 and 2 (popularly knownas COX-1 and COX-2) (Seeram and Momin et al. 2001). Some pain medication works by inhibiting COX-1 andCOX-2, which may explain why some people find that tart cherries help ease the pain of arthritis and gout. The researchers found that cherries were the richest source of these beneficial compounds compared to variousberries, including raspberries, blackberries and strawberries. Anthocyanins 1 and 2 were not found in blueberries. Tart cherries contain 30 to 40 milligrams of anthocyanins 1 and 2 in every 100 grams of fruit. Tart cherries contain significantly more anthocyanins and phenols than do sweet cherries. For example, one study foundthat the total phenolic content of sweet cherries ranged from 92 to 147 milligrams/100 grams, while the sameamount of tart cherries contained up to 312 milligrams, or more than twice the phenols (Kim 2005, Chandra 1992). 4Source: Seeram and Momin et al. 2001. Anthocyanins are more effective than vitamin C, four times more potent as an antioxidant than the well-knownvitamin 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 Baltimoreconcluded that anthocyanins in tart cherries significantly lowered inflammation and pain in animals. The proposedmechanisms are due to anthocyanins’ anti-inflammatory and antioxidant properties, which lower oxidative stressfollowing inflammatory insult (Tall 2004). Asfor the potency of COX inhibition, researchers indicate that one serving of tart cherries (canned) is the equivalentof 1. 41 grams of aspirin. A serving of tart cherry juice contains the equivalent of 0. 30 grams of aspirin; and frozencherries equal 0. 90 grams. A standard aspirin tablet is 0. 325 grams. ANTIOXIDANTSOxygen is an important component of the air we breathe. We couldn’t survive without it. But oxygen can alsobe a source of free radicals – unstable oxygen molecules associated with cancer, heart disease and the effects of aging. Luckily, antioxidants can counter, scavenge, and deactivate these damaging free radicals. Thousands of studies spanningdecades of research consistently and repeatedly show that maintaining a high antioxidant defense system lowersa person’s risk for disease, stimulates the immune system, protects brain neurons from damage, and possibly evenslows the aging process. Oxidative stress associated with disease occurs when oxidative damage exceeds our antioxidant defenses. Thatantioxidant system depends on the food we eat. A lab testing procedure called Oxygen Radical Absorbance Capacity or ORAC measures the total antioxidantcapacity 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 afood may be in helping our bodies fight diseases like cancer and heart disease. Nutrition experts estimate a person needs to consume 3, 000 to 5, 000 ORACunits a day to reach a significant antioxidant capacity in the blood associated withhealth benefits. Just slightly more than 3 ounces (100 grams) of tart cherry juiceconcentrate supplies 12, 800 ORAC units. Just one ounce supplies 3, 622 ORACunits, or more than an entire day’s recommendation. A quarter cup of driedcherries rates 3, 060 on the ORAC scale and a half cup of frozen tart cherriessupplies, on average, 1, 362 ORAC (Wu 2004). A recent study published in the American Journal of Clinical Nutrition found that tart cherries ranked 14 in the top50 foods for highest antioxidant content per serving size – surpassing well-known leaders such as red wine, prunes, dark chocolate and orange juice (Halvorsen 2006). OTHER PHENOLIC COMPOUNDSTart cherries are rich sources of other phenolic compounds, such as gallic acid, p-coumaric acid, kaempferol, andquercetin, all of which are potent antioxidants. According to researchers at the University of California, ellagic acidis a potent antioxidant, anti-cancer, and anti-atherosclerotic compound (Seeram 2004). One study found thatellagic acid in fruit extracts reduced cancer cell proliferation in a dose-dependent fashion; that is, as ellagic acidincreased, cancer cell growth decreased (Ross 2007). P-coumaric acid is another phenolic compound that exhibits strong antioxidant activity (Kim 2005). An in vitrostudy of human leukemia cells, found that p-coumaric acid, along with gallic acid and other phenols, enhancedcancer cell death (Dedoussis 2005). 56MELATONINTart cherries are one of the few known food sources of melatonin, a potent antioxidant that helps improve thebody’s circadian rhythms and natural sleep patterns (Burkhardt 2001). A study conducted by Reiter and colleaguesat the University of Texas Health Science Center found that tart cherries contain substantial amounts of melatonin, at levels higher than normally found in human blood. Montmorency cherries, which account for the majority oftart 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 muchmore 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 foundthat feeding chicks a diet containing plants rich in melatonin raised blood levels of melatonin, indicating that melatoniningested from the diet is absorbed and enters the general circulation, after which it is capable of binding to sitesin the brain and other tissues (Hattori 1995). Reiter and colleagues speculate that eating just a handful of tart cherries will increase melatonin levels in blood, thereby improving the body’s natural sleep patterns and potentially providing other health benefits. Potential Health Benefits of Tart CherriesTart cherries and their compounds have been associated with a lowered risk for a number of diseases and disorders. ARTHRITIS AND GOUTFor decades, tart cherries have quietly grown a devoted fan base of arthritis sufferers who routinely consumedthe 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 witharthritis. After eating the cherries, the patients in the study had lower blood levels of uric acid. Elevated levels ofuric 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 ResearchCenter 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 inuric 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 withgout. Additional studies suggest that consumption of cherries may be beneficial for the management and preventionof inflammatory diseases (Kelley 2006, van Acker 1995), including inflammatory pain (Tall 2004). Nitric oxide also has been implicated in both osteoarthritis and rheumatoid arthritis, while studies show that antioxidantsscavenge this oxidant and potentially aid in the treatment or prevention of symptoms (Bezerra 2004, Remans 2005). HEART HEALTHStrong evidence indicates that diets rich in colorful fruits and vegetables may help lower heart-disease risk. Beyond the anti-inflammatory benefits, many of the phenolic compounds in cherries may offer protection againstheart disease and stroke. The Zutphen Elderly Study is a longitudinal study on lifestyle and chronic diseases started in 1985 at the NationalInstitute of Public Health and Environmental Protection in The Netherlands. It has produced a wealth of valuableinformation about diet and health. One published report from this study of 805 men (ages 65 to 84 years) whowere followed for five years found that as flavonoid intake increased, the risk for coronary artery diseasedecreased. The relative risk for dying from heart disease was 58 percent lower in those men who consumed themost 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 ofMedicine 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 vasorelaxant effect on rat arteries that might help reduce cardiovascular mortality (Andriambeloson 1998). Numerousother studies show that other phenolic compounds found in tart cherries, such as quercetin, protect low density lipoproteins (LDL – the " bad" cholesterol) from oxidative damage, thus reducing their atherogenicity (Safari 2003). Anthocyanins in tart cherries also might lower blood lipids, thus reducing heart disease risk. In a study from theUniversity of Michigan, varying amounts of whole tart cherry powder were fed to rats for 90 days. Results showedthat the cherry-enriched diets significantly lowered plasma triglyceride and total cholesterol, fasting glucose andinsulin, 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 " fattyliver" or the accumulation of triglcyeride and cholesterol in the liver. (Seymour 2007). C-Reactive ProteinTart cherries also may lower inflammatory processes associated with heart disease. C-reactive protein (CRP) isa substance found in blood that is a marker for inflammation in the body. High levels of this protein are associatedwith an increased risk of heart disease and low levels with a low risk. The link between elevated CRP levels andheart disease has been demonstrated repeatedly, and there is evidence that CRP may be a more important indicatorof heart disease risk than high LDL (" bad") cholesterol. In an eight-year study involving 27, 939 women at Brighamand Women's Hospital in Boston, more than half of the women who eventually developed heart disease had highCRP 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 25percent reduction in CRP levels, suggesting reduced inflammation associated with atherosclerosis risk (Kelley 2006). CANCER PREVENTIONResearchers believe tart 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 anti-cancer effects of tart cherries in mice andhuman colon cancer cell lines (Kang 2003). In the study on mice, a diet containing cherries, anthocyanins, or cyanidinproduced significantly fewer tumors compared to mice fed control diets. In the second study on human colon cancercells, anthocyanins and cyanidin reduced cell growth. The researchers concluded that "... tart cherry anthocyaninsand cyanidin may reduce the risk of colon cancer." A review of the research published in the Journal of Biomedicine and Biotechnology concluded that anthocyaninsin tart cherries may help inhibit tumor development and growth of human colon cancer cells (Blando 2004). 78Perillyl AlcoholCherries are rich in a phytonutrient called perillyl alcohol (POH), which is a member of the monoterpene family, along with limonenes. Numerous studies indicate that POH may help prevent the formation and progression ofcertain cancers. How POH inhibits the growth of cancer is under investigation. Evidence suggests it helps rid thebody of carcinogenic chemicals or interferes with signals that cause cells to divide rapidly. POH also might helprevert tumor cells back to normal or differentiated cells so they are less likely to become cancerous (Belanger1998). One study found that POH might help reduce the blood supply to cancer cells, thus starving them of oxygenand nutrition and aiding in their demise (Loutrari 2004). At the University of Wisconsin-Madison, researchers found that leukemia cells self-destructed (a condition calledapoptosis) when exposed to POH in vitro (Clark 2006). POH has been shown to induce the regression of 81 percent of small breast cancers and up to 75 percent ofadvanced breast cancers in animal studies (Haag 1994). POH was up to five times more potent than the otherknown cancer-reducing compounds at inducing tumor regression. Several studies also show that POH might aid in reducing a type of brain cancer called glioblastoma multiforme. This type of cancer forms from glial or support tissue in the brain. It progresses rapidly, is difficult to treat, andprognosis is poor. A study from the University of Wisconsin found that POH helped sensitize glioma cells to radiationand chemotherapy, thus possibly being useful as an adjunct therapy to conventional treatments for this form ofbrain cancer (da Fonseca 2006, Fernandes 2005, Rajesh 2003). Additional studies suggest POH might lower the risk for cancers of the prostate (Chung 2006), breast (Yuri 2004, Wagner 2002), lungs (Xu 2004), liver (Crowell 1999), and skin (Barthelman 1998). DIABETESTart cherries and their compounds appear to aid in diabetes control and in reducing the complications associatedwith this disease. In a study from Michigan State University, partially funded by the U. S. Department of Agriculture, the effects ofextracts of anthocyanins from tart cherries were tested on mouse pancreatic cells, which produce the hormoneinsulin in the presence of glucose (sugar). Results showed that anthocyanin-exposed cells increased insulin productionby 50 percent compared to cells not exposed to anthocyanins. The researchers conclude that cherries might beuseful in the prevention of type 2 diabetes (Jayaprakasam 2005). In another study on rats, a single dose of anthocyanins decreased fasting blood glucose levels by 19 percent andimproved glucose tolerance by 29 percent. After one month of treatment with anthocyanins, fasting blood glucoselevels had dropped to half of the pretreatment 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. Collagenproteins become linked to the elevated sugar and form abnormal complexes that damage tissues and blood vessels. One study on rats 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 toblood 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 (Boniface1996). In another study, 31 patients with diabetic retinopathy showed marked improvement in permeability anda reduced tendency to hemorrhage when treated with anthocyanins (Scharrer 1981). Studies have shown that tart cherries have a low glycemic index (GI) score of 54 (any score less than 55 is considered low), thus producing only a mild rise in blood sugar levels associated with lowered risks for diabetes andweight gain. Dried cherries have a moderate score of 58. Canned cherries have a higher GI score of 76, possiblybecause of the effects of processing (Glycemic Index Laboratories, Toronto, Canada). BRAIN HEALTHThe 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 phytonutrientsin tart cherries aid in protecting neurons in the brain from oxidative damage associated with neuronal loss. Researchers at USDA’s Human Nutrition Research Center on Aging at Tufts University in Boston state that thereis "... ample research [that] indicates age-related neuronal-behavioral decrements are the result of oxidative stressthat may be ameliorated by antioxidants"(Joseph 1999). This oxidative damage has been linked to a higher riskfor memory loss, dementia, and even Alzheimer’s disease, while antioxidant-rich phytonutrients, such as the phenols, help reverse the course of neuronal and behavioral aging, and possibly improve memory (Gailli 2002, Joseph1996, Andres-Lacueva 2005, Shukitt-Hale 2006, Lau 2005). In a study from Korea, cherry phenolics protected brain neurons from oxidative damage in a dose-dependentfashion, 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 showedthat rats fed anthocyanins had significantly less damage to brain tissue from reduced blood supply caused bystroke. The researchers concluded that "... consumption of anthocyanins may have the possibility of a protectiveeffect 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 invarious 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 antioxidantprotection (Galli 2002). OTHER HEALTH BENEFITSTart cherries or their compounds also may have additional benefits, although the research i