

Muscadine Grape and its Antioxidant Activity

By Mehrdad Rahmaniyan, M.D.
Department of Medicine
Medical University of South Carolina

November 16, 2012

Free radicals (FR) are chemical species with a single unpaired electron in an outer orbital. Such chemical states are extremely unstable and react with inorganic and organic chemicals and if generated within a cell, they attack and degrade nucleic acids (components of DNA) as well as a variety of membrane molecules, resulting in variety of cell injuries including:

1. Membrane damage due to reaction of FR with membrane polyunsaturated fats.
2. Damage to DNA, the genetic material of a cell, and if the damage persists and without repair by DNA repair system, it may contribute to malignant transformation (cancer development).
3. Cross-linking with important proteins within a cell leading to loss of function of proteins (enzymes) and their degradation.

In recent years, many studies have revealed that FRs are the leading cause of degenerative diseases, such as cardiovascular disease, many types of cancers, and neurological disorders.

The best way to protect the body from these harmful molecules is the regular intake of antioxidants. Antioxidants work as singlet or triplet oxygen quenchers, free radical scavengers, and enzyme (protein) inhibitors. Antioxidants are best available in vegetables and fruits. **Phenolics are secondary plant metabolites with antioxidant capacity found in the majority of fruits, vegetables, and teas.** Many studies showed the positive effects of antioxidants in preventing many diseases. An excellent example of fruits with antioxidant capacity is muscadine grape.

Muscadine grape (*Vitis rotundifolia*) is a type of grape distinct from the more common red grapes used to produce red wines, a major source of resveratrol. **Muscadine grapes contain unique phytochemical constituents compared with other grapes and are potentially a source of important compounds with antitumor activities.** One study compared the phenolic content of seeds, skin, and leaves of Muscadine grape. The study showed that most phenolics are located in the seeds and skin. Muscadine pulps have a very low content of phenolics.

Seeds of muscadine grapes have higher antioxidant capacity in comparison to other fruit parts, which may be due to their high concentrations of three phytochemicals catechin, epicatechin, and gallic acid (three major phenolics). Thus, grape seeds are suitable raw materials for production of antioxidative dietary supplements. This fact was also confirmed by another study, published in the Journal of Agricultural and food chemistry in 2004. These three phenolics scavenge important radicals. For instance, epicatechin is able to scavenge hydroxyl, peroxy, and superoxide radicals. One study showed that despite the possibility of the transfer of phenolics from the grape extract to the wine during the winemaking process and the possible loss of some of these compounds by oxidation during the air-drying process, the seeds' byproducts are better sources of antioxidant compounds suitable for use as dietary supplements.

In addition to their anti-cancer effects, grape seed extracts have a strong anti-bacterial effect. One study in 2009 showed that a water-soluble muscadine seed extract has strong antimicrobial inhibition against a bacterium called *Enterobacter Sakazakii* which causes opportunistic infections, for instance,

meningitis and enterocolitis in infants with high mortality rates. This type of bacterium has been isolated from infant's cereal, raising the concern that it can grow rapidly in infant's cereals. **Interestingly, this study showed that the malic, tartaric, and tannic acids found in the seed extracts can be used as natural antimicrobial agents against *E. Sakazakii*.**

Another study showed that the grape seed and skin extract has an antibacterial effect against *Helicobacter pylori*, a well known agent of peptic ulcer (stomach ulcer) that has been associated with development of lymphoma (a type of cancer of lymphoid tissue in the mucosa of the stomach). **Thus, this extract describes a natural way to treat *Helicobacter pylori* infections of stomach, thus preventing cancer development.**

The effects of muscadine grape seeds on cardiovascular disease are currently ongoing. Only one study showed that this extract may cause an increase in resting diameter of a certain artery of the arm. The significance of this effect is not established yet and research is ongoing.

I conclude that the grape seed extract has a miracle effect not only in prevention of cancer development by eliminating of free radicals, but also has an apoptotic (killing) effect on cancer cells. The mechanism of action of grape seed extract on cancer cells is an interesting area to study. The compounds in grape seeds may act on different pathways in cell growth and also may act on proteins responsible for cell cycle and cell division. In addition to anti-cancer effect, muscadine grape seed extract has anti-bacterial effects that can be used in cases where patients cannot tolerate medications due to side effects. The cardiovascular effects are currently under investigations and I'm sure that studies will be performed showing positive results of this miracle fruit. This extract is a wonder from nature.

Mehrdad Rahmaniyan, M.D.
Department of Medicine
Medical University of South Carolina
Charleston, South Carolina

Dr. Rahmaniyan is a "Hyundai Hope on Wheels" Scholar. MUSC received a \$250,000 Hope Grant Sept. 6 to support research focused on the treatment of neuroblastoma (one of the deadliest childhood cancers), becoming one of 41 recipients of Hope On Wheels' 2012 Hyundai Hope Grants (<http://www.musc.edu/catalyst/archive/2012/co9-21hyundai.html>). Dr. Rahmaniyan has written several research papers, and in the open access book "Neuroblastoma - Present and Future," he authored Chapter 8 (<http://www.intechopen.com/books/neuroblastoma-present-and-future/bioactive-sphingolipids-in-neuroblastoma>).