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| **Introduction**  The human diet has evolved over the course of time to include foods that possess both mentally and physically healthy attributes. By eating healthy foods and avoiding those that are less desirable, a person has been noted to achieve longevity and better health. In addition to eating "regular" foods, nutritional supplements also offer valuable nutrients. The history of dietary supplements and alternative forms of medicine have existed for many years, and several of these ancient remedies have paved the way for more extensive studies into the benefits of "natural cures." During the 1970�s a French Professor, Jacques Masquelier of the University of Bordeaux, France, used the observations of an ancient French explorer from the 1500�s to base his own studies. The French explorer, Jacques Cartier, was traveling in North America when his men became afflicted with scurvy, caused by a lack of Vitamin C. Cartier wrote about how they were cured when an Indian Native recommended that they drink tea made from the bark of pine trees. Because vitamin C is the cure for scurvy, Masquelier assumed that vitamin C was present in the tree bark. After further analysis of the bark and extended studies into grape seeds, Professor Masquelier discovered the presence of a different nutrient, Proanthocyanidins.  Proanthocyanidins are naturally occurring polyphenolic bioflavonoids widely available in fruits, vegetables, nuts, seeds, flowers, and bark (1). Grape seed and pine bark extracts are both excellent sources of proanthocyanidin, yet because the majority of studies have been performed on *grape seed* proanthocyanidin, it has become the preferred product. Professor Masquelier also demonstrated that grape seed extract is more effective because it has "gallic esters." The "gallic esters," which are not present in bark extract, are the most active component of the bioflavonoids (14). Other than proanthocyanidins, grapes contain other antioxidants including resveratrol, catechin, and epicatechin (2). While the resveratrol is primarily located in the skin of the grape, Proanthocyanidins are most abundant in the seeds (Kovac et l., 1995).  Although proanthocyanidins are the main subject of this study, the study of grapes as being a beneficial bioflavonoids also began when Drs. Langcake and Pryce discovered the presence of resveratrol in grapevine tissues (13). Dr. Langcake and Dr. Pryce later became aware that resveratrol was a natural antibiotic produced by plants to fight off fungi, bacteria, or viruses. With this knowledge the doctors continued to perform studies about the effects of resveratrol on humans. It was through these early pioneers that grape seed proanthocyanidin would be extensively studied.  **PROANTHOCYANIDIN AS AN ANTIOXIDANT**  The Proanthocyanidin found in grape seed extracts are "antioxidants which are known to possess a broad spectrum of biological, pharmacological and chemoprotective properties" (6). As an antioxidant, proanthocyanidins inhibit the destructive properties of free radicals found throughout the body. The chemical makeup of bioflavonoids provides available hydrogen atoms as "free radical scavengers" (5). Free radicals are reactive molecules that cause the "oxidative deterioration of cell tissues, lipids, proteins, and DNA" (4). Virtually unavoidable, free radicals enter the body as a result of daily exposures and activities such as, exercise, stress, smoking, pesticides, pollution, sunlight, and also the "body�s natural process of metabolizing air" (4). Furthermore, free radicals have been attributed to causing many diseases, including arthritis, cardiovascular diseases, tumors, and organ deterioration (4,5). Although vitamins from fruits and vegetables should be sufficient in fighting off naturally acquired free radicals, humans have created an environment less suited for natural remedies. Abundant with pollution, pesticides, and a depleted ozone layer, humans have dramatically increased the intake of free radicals, and made natural vitamins insufficient. In response to the exceeding amount of free radicals, scientists have extensively studied the beneficial effects of antioxidants.  Proanthocyanidins have shown significant antioxidant capabilities in numerous ways. Grape seed extract has been used in cardiovascular, cancer, drug, and antioxidant research. When compared with Vitamins C, E, and beta-carotene, grape seed proanthocyanidin showed "significantly greater protection against oxygen free radicals" (7). Furthermore, proanthocyanidins have shown results in protecting against the harmful effects of smoking. Tobacco use increases the consumption of free radicals and causes **apoptosis**, which is the death of a cell in "pathological conditions" (7). Apoptosis is triggered by a high content of free radicals, and is linked with several diseases such as cancer, heart disease, and Alzheimer�s disease (9). During a study done by Doctor M. Bagchi, grape seed proanthocyanidin extract reduced apoptosis in tobacco treated cells by 85%, while a combination of vitamins C and E reduced apoptosis by only 46% (7). According to this study it can be concluded that grape seed proanthocyanidins may potentially reduce the chances of cancers created by tobacco use.  An increase in cardiovascular diseases has also prompted research into alternative dietary solutions. A study by Dr. Bagchi and his colleagues was done to observe whether grape seed extract possesses cardioprotective properties. Rats were given grape seed proanthocyanidin to examine the effect of the extract on the heart. After submitting the hearts to **ischemia**, which is blocking the flow of blood, the blood flow was restored (called **reperfusion**). It is through reperfusion that the heart receives the most oxidative damage to the muscle (2,8). The results of the experiment showed that hearts treated with the grape seed extract recovered better after reperfusion than those without (8). Damage to the hearts were also significantly less when the proanthocyanidin was present (2).  Due to many promising reports about the beneficial effects of proanthocyanidins on tobacco caused cell death, scientists decided to test bioflavonoids on cancerous cells. Human breast and lung cancer cells, along with stomach and leukemic cells were used to observe the potency of proanthocyanidins. The results of the experiments were very promising and suggested that grape seed proanthocyanidin (GSPE) could potentially be a tool in curing cancer. *"Following incubation of the breast cancer cells with 25mg/L of GSPE, approximately 7%, 30%, 43% reductions in cell growth were observed at 24, 48, and 72 hours, respectively, while incubation of the breast cancer cells with 50mg/L of GSPE, resulted in 11%, 35%, and 47% inhibition in cell growth at these same time points , respectively" (10).* In addition to the breast cancer cells, the lung cancer and the stomach cells provided similar results (10). As indicated by this study, the grape seed extract (GSPE) had considerable effect on a few of the leading forms of cancer in the US.  **CULTURAL EVIDENCE**  Diets vary among different cultures, and as a result, different races of people are more immune to certain illnesses than others. Developed countries such as the United States and the United Kingdom have a strong correlation between the intake of fatty foods and the mortality rate from heart disease, yet France exhibits a discrepancy in this claim. It is a known fact that fatty foods, high in saturated fat and cholesterol, are primary causes of coronary heart disease. Although the French population maintains a highly fat diet, the natives seem to have a low incidence of coronary diseases. In order to explain France�s immunity to heart diseases, scientists turned to analyzing the diets of French people. Coined the "French Paradox," scientists have associated this phenomena with the strong presence of wine in the French diet (3,13).  Another group of people that have shown evidence of bioflavonoids protection are Asians. Breast, ovarian, and prostate cancers among Asians is significantly less than other races due to higher blood levels of phytoestrogens (13). Phytoestrogens are compounds found in plants that assume similar characteristics to that of steroidal estrogens produced by the body. According to recent studies phytoestrogens "exhibit anticarcinogenic" properties by protecting against "estrogen-dependent" cancers such as breast and prostate cancer (13). These bioflavonoids are separated into three classes; isoflavonoids, phytoalexins, and coumestans. Phytoalexins are primarily found in grapes and in turn found in wine. Isoflavonoids, on the other hand, are found in tofu and miso, which are heavily consumed in the Asian culture (13).  Bioflavonoids such as grape seed proanthocyanidins and others found in fruits and vegetables have continuously proven themselves as being an asset to the human diet. Historical and present day evidence has surfaced which has encourage extensive research in this field. Because there is a possibility of naturally protecting against incurable diseases such as cancer and heart disease, bioflavonoids will always be a topic of research.  **PROANTHOCYANIDIN IN WINE**  Historically, wine has been noted as one of the oldest and most cherished drinks because of its use for medicine and pleasure. The medicinal uses of wine even date back to biblical times when Noah "raised grapes and made wine" (13). The study of grapes and wine has had an extensive history that has carried itself into the scientific world today. In an attempt to uncover why wine has such an advantageous effect on health, scientists have incorporated the study of grape seed, skin, and pulp into their research.  Heart disease has become a major health issue in America, accounting for one in three deaths of every human (13). In spite of this great number of deaths attributed to heart disease, France has a significantly less mortality rate from coronary problems. The bioflavonoids present in grapes allow wine to posses antioxidant characteristics that actually help the body. It is estimated that if every adult in North America drank two glasses of red wine, deaths from heart disease would reduce by 40 percent (13). In addition to the grapes, alcohol also possesses healthful attributes. "Alcohol in wine, if consumed in small amounts, increases the amount of beneficial cholesterol (high density lipoprotein cholesterol) and reduces platelet coagulability" (13). The antioxidants from the grapes protect against the unhealthy cholesterol (low-density lipoprotein cholesterol). After studying the effects of wine, researchers deduced that red wine has a higher antioxidant potency. Unlike white wine, red wine is fermented in the presence of grape skin and the grape seeds which contain high concentrations of proanthocyanidins (5).  Because grapes have such a wide variety of beneficial attributes we decided to see if grape seed proanthocyanidin possessed antibacterial properties.  [[Home](http://docs.google.com/home.html)][[Introduction](http://docs.google.com/introduction.html)][[Hypothesis](http://docs.google.com/hypothesis.html)][[Procedure](http://docs.google.com/procedure.html)][[Data](http://docs.google.com/data.html)][[Conclusions](http://docs.google.com/conclusions.html)][[Bilio/Links](http://docs.google.com/biblio.html)]  [[2001 Projects](http://docs.google.com/index.html)][[2000 Projects](http://docs.google.com/AP2000/index.html)][[1999 Projects](http://docs.google.com/AP99/index.html)][[1998 Projects](http://docs.google.com/AP98/index.html)] |