Scientifically Proven Health Benefits of Oil No. 57

1. Introduction

Grapeseed oil has a very sweet, light and slightly nutty aroma, for which it is preferred by most of the people. Usually clear in color, at times, it has a tinge of yellow/green. Quite thin in consistency, it easily penetrates into the skin. The botanical name of grapeseed is Vitus vinifera. There are distinctive varieties of Vitus vinifera grapes, which are basically a by product of wine making. Grapeseed oil is primarily produced in Italy. Other producing nations are Spain, France and Argentina. Grapeseed oil also known as grape oil possesses a few qualities of astringent and thus its application helps to tighten and tone the skin. It is of great use in treating the stubborn acne and other skin problems. Grapeseed has a high content of linoleic acid, a fatty acid essential for the cell membranes and the skin. Grape seed oil serves as a wonderful moisturizer and truly nourishes the skin. This carrier oil lends a shimmering touch to the skin. Grape seed oil offers innumerable health benefits and this explains the reason why it is extensively brought to use.

2. Chemical components of Grape Seed Oil

Chemical composition of the virgin oil obtained by mechanical pressing form several grape seed varieties (Vitis vinifera L.) with emphasis on minor constituents

The chemical composition of the virgin oils obtained by mechanical pressing of grape seed belonging of the varieties Syrah and Tintorera as well as a mixture of seeds of the varieties Syrah, Tempranillo and Merlot was determined. Official analytical methods were employed for the determination of two quality indexes (acidity and peroxide value), fatty acids profile and for the quantification of the most important minor constituents. The acidity and the peroxide values were in agreement with the values reported by the Codex Alimentarius for good quality edible oils. The linoleic acid was the fatty acid most abundant in all samples, representing around the 65%, followed by the monounsaturated oleic acid with concentrations close to 25%. The total phytosterol concentrations were between 5179 and 5480 mg/kg, where the beta-sytosterol represented more than the 66% in all grape seed oils. The cholesterol was detected in the oils from the varieties Syrah and Tintorera in concentrations below the maximum allowed for vegetable edible oils. The ester 1-buthyl-3-methylacetate was the most abundant in the volatile fraction with concentrations of 5.4; 6.8 and 11.0 mg/kg for Syrah, Tintorera and the seeds mixture respectively. Other volatile compounds also present were the Trans-2-hexenal (0.1 to 0.5 mg/kg), E-2-pentenal (3.1 to 4.2 mg/kg), hexanal (1.4 to 1.9 mg/kg) and heptanal (0.1 to 0.3 mg/kg). These compounds may be the responsible for the fruity flavor detected in all virgin oils studied. The alpha and gamma isomers of the tocotrienols accounted for more than the 80% of the tocochromanols present in the oils, while the tocopherols represented only the 10%. The deep green color observed in all oil samples was associated to the presence of chlorophylls and other vegetable pigments.

3. Clinical studies

Antioxidant effect

Defatted milled grape seed protects adriamycin-treated hepatocytes against oxidative damage

Defatted milled grape seed (DMGS) is a wine by-product obtained from the oil extraction of the grape seed that contains different types of phenolic compounds. The present study was designed to evaluate the possible protective effect of DMGS on toxicity induced by adriamycin (ADR) in isolated rat hepatocytes. The study was carried out by examining the results of lactate dehydrogenase (LDH) release to estimate cytotoxicity; the thiobarbituric acid reactant substances (TBARS) and carbonyl group levels were measured as biomarkers of oxidative stress and ATP and GSH levels as estimation of intracellular effect. The results showed that DMGS extract protects the cellular membrane from oxidative damage and consequently prevents protein and lipid oxidation. The levels of ATP and GSH changes for the ADR toxicity were restored to control value in the presence of DMGS extract. The experimental results suggest that this wine by-product may be used to decrease oxidative stress.

Studies on antioxidant effects of the red grapes seed extract from Vitis Vinifera, Burgund Mare, Recaş in pregnant rats

To estimate the effects of hydroethanolic red grapes seeds extract obtained from Vitis vinifera, Burgund Mare variety, Recaş , Romania (BMR) on oxidant-antioxidant ballance, as compared to ascorbic acid, during pregnancy in rats. Thirty Wistar female rats were assigned to three groups (n=10) which were administered by gavage: Group I, 3 x 100 mg/kg body weight saline, Group II - BMR 3 x 30 mg gallic acid equivalents/kg body weight; Group III - vitamin C 3 x 100 mg/kg body weight on days 1, 7 and 14 of pregnancy. On day 21 blood samples were collected. Malon dyaldehyde, lipid peroxides, protein carbonyls, nitric oxide (as oxidative stress parameters) and hydrogen donor ability and total thiol groups (as antioxidant parameters) serum concentrations were measured. Vitamin C significantly enhanced the antioxidant capacity of plasma (hydrogen donor ability, p=0.0001; thiol groups, p=0.0001), as well as nitric oxide levels (p=0.001). The extract increased the plasma antioxidant capacity (hydrogen donor ability, p=0.001; thiol groups p=0.001) and did not elevate the nitric oxide plasma levels in pregnant rats. In conclusion, in the chosen dose, the red grapes seed extract enhanced the plasma antioxidant capacity and did not influence the nitric oxide levels in pregnant rats.

Antibacterial activity

Bactericidal effect of grape seed extract on methicillin-resistant Staphylococcus aureus (MRSA)

The study was conducted to measure the antibacterial activity of grape (Vitis vinifera L; Vitaceae) seed extract against methicillin-resistant Staphylococcus aureus (MRSA). Grape seed and skin extracts were tested for antibacterial activity against forty-three strains of MRSA by gel diffusion, growth and respirometric studies. All MRSA strains were found to be sensitive to grape seed extract. Complete inhibition of all bacterial strains tested was observed at a concentration of 3 mg/ml crude grape seed proanthocyanidins extract (GPSE), equivalent of 20.7 microg/ml flavonoid content. Antibacterial activity was bactericidal as shown by a disruption of the bacterial cell wall in scanning and transmission electron microscopy. Grape seed extract is known to be rich in potent antioxidant polyphenolics that could show antibacterial activity. Phenolic compounds in the grape seed extract were assayed by Folin-Ciocalteu's reagent. The considerable antibacterial activity of commonly available grape seed extract could signify a major advancement in the treatment of MRSA diseases.

Grape seed extract inhibits the growth and pathogenicity of Staphylococcus aureus by interfering with dihydrofolate reductase activity and folate-mediated one-carbon metabolism

Staphylococcus aureus (S. aureus) is one of the most common pathogens that causes infectious and foodborne diseases worldwide. Searching for drug and chemical compounds against this bacterium is still in demand. We found that grape seed extract (GSE), a natural food product rich in polyphenols, inhibited the dihydrofolate reductase activity and growth of S. aureus. In addition, the intracellular content of tetrahydrofolate (THF), the major folate species identified in S. aureus, was significantly decreased when GSE was present in medium. The GSE-induced growth inhibition was reversed by adding, THF, 5,10-methylenetetrahydrofolate or methionine to the medium. The differential rescuing effects

elicited by thymidine and methionine indicated that GSE-induced perturbation in folate-mediated one-carbon metabolism has more profound impact on methionine cycle than on thymidine monophosphate (TMP) synthesis. Significantly reduced inflammatory responses and mortality were observed in zebrafish infected with S. aureus pre-incubated with GSE. We conclude that GSE might serve as an effective natural alternative for the control of food poisoning caused by S. aureus with proper safety measure.

Cardioprotective effect

Grape seed extract enhances eNOS expression and NO production through regulating calcium-mediated AKT phosphorylation in H2O2-treated endothelium

Grape seed extract (GSE) has been shown to exhibit protective effects against cardiovascular events and atherosclerosis, although the underlying molecular mechanisms of action are unknown. Herein, the ability of GSE to enhance endothelial nitric oxide synthase (eNOS) expression and nitric oxide (NO) production in hydrogen peroxide (H2O2)-treated human umbilical vein endothelial cells (HUVEC) was assessed. GSE enhanced eNOS expression and NO release in H2O2-treated cells in a dose-dependent manner. GSE inhibited intracellular ROS and reduced intracellular calcium in a dose-dependent manner in H2O2-treated cells by confocal microscopy. ROS was inhibited in cells pretreated with 5.0 microM GSE, 2.0 mM thapsigargin, and 20.0 microM 2-aminoethoxydiphenyl borate (2-APB) instead of 0.25 microM extracellular calcium. In addition, GSE enhanced eNOS expression and reduced ROS production via increasing AKT phosphorylation with high extracellular calcium (13 mM). In conclusion, GSE protected against endothelial injury by up-regulation of eNOS and NO expression via inhibiting InsP3Rs-mediated intracellular calcium excessive release and activating AKT phosphorylation in endothelial cells.

Grape seed proanthocyanidins ameliorate Doxorubicin-induced cardiotoxicity

Doxorubicin (Dox) is one of the most widely used and successful chemotherapeutic antitumor drugs. Its clinical application is highly limited due to its cumulative dose-related cardiotoxicity. Proposed mechanisms include the generation of reactive oxygen species (ROS)-mediated oxidative stress. Therefore, reducing oxidative stress should be protective against Dox-induced cardiotoxicity. To determine whether antioxidant, grape seed proanthocyanidin extract (GSPE) attenuates Dox-induced ROS generation and protects cardiomyocytes from Dox-induced oxidant injury, cultured primary cardiomyocytes were treated with doxorubicin (Dox, 10 microM) alone or GSPE (50 microg/ml) with Dox (10 microM) for 24 hours. Dox increased intracellular ROS production as measured by 6-carboxy-2',7'-dichlorodihydrofluorescein diacetate, induced significant cell death as assessed by propidium iodide, and declined the redox ratio of reduced glutathione (GSH)/oxidized glutathione (GSSG) and disrupted mitochondrial membrane potential as determined by 5,5',6,6'-tetrachloro-1,1',3,3'-tetraethlbenzimidazole-carbocyanide iodine (JC-1). Analysis of agarose gel electrophoresis revealed Dox-induced nuclear DNA damage with the ladder like fragmentation. GSPE treatment suppressed those alterations. Electron Spin Resonance (ESR) spectroscopy data also showed that GSPE strongly scavenged hydroxyl radical, superoxide and DPPH radicals. Together, these findings indicate that GSPE in combination with Dox has protective effect against Dox-induced toxicity in cardiomyocytes, which may be in part attributed to its antioxidative activity. Importantly, flow cytometric analysis demonstrated that co-treatment of Dox and GSPE did not decrease the proliferation-inhibitory effect of Dox in MCF-7 human breast carcinoma cells. Thus, GSPE may be a promising adjuvant to prevent cardiotoxicity without interfering with antineoplastic activity during chemotherapeutic treatment with Dox.

Diabetes beneficial effect

Protective effects of grape seed proanthocyanidin extracts on cerebral cortex of streptozotocin-induced diabetic rats through modulating AGEs/RAGE/NF-kappaB pathway

Diabetic encephalopathy is a severe complication in patients with long-term hyperglycemia. Oxidative stress is thought to be closely implicated in this disorder, so in this study, we examined whether grape seed proanthocyanidin extract (GSPE), a naturally occurring antioxidant derived from grape seeds, could reduce the injuries in the cerebral cortex of diabetic rats by modulating advanced glycation end products (AGEs)/the receptor for AGEs (RAGE)/nuclear factor-kappa B p65 (NF-kappaB p65) pathway, which is crucial in oxidative stress. Body weight and serum AGEs were tested; cerebral cortexes were isolated for morphological observations and the pyramidal cell layers were immunohistochemically stained for the detection of RAGE, NF-kappaB p65, intercellular adhesion molecule-1 (ICAM-1) and vascular cell adhesion molecule-1 (VCAM-1) as well. For RAGE and NF-kappaB p65, quantitative reverse transcriptase coupled to polymerase chain reaction (RT-PCR) was employed for determination of mRNA levels, and western blot was used to detect protein expression. The results showed that long term hyperglycemia in diabetic rats caused the degeneration of neurons and the up-regulation of serum AGEs, and also the up-regulation of RAGE, NF-kappaB p65, VCAM-1 and ICAM-1 in the brain. We found that GSPE treatment improved the pathological changes of diabetic rats by modulating the AGEs/RAGE/NF-kappaB p65 pathway. This study enables us to further understand the key role that the AGEs/RAGE/NF-kappaB pathway plays in the pathogenesis of diabetic encephalopathy, and confirms that GSPE might be a therapeutical means to the prevention and treatment of this disorder.

The Effect of Grape Seed Extracts on Serum Paraoxonase Activities in Streptozotocin-Induced Diabetic Rats

Abstract Procyanidins, a group of flavonoids, are oligomeric forms of catechins that are abundant in red wine, grapes, cocoa, and apples. Paraoxonase acts as an antioxidant enzyme and protects low-density lipoprotein-cholesterol against oxidation. In our study we aimed to evaluate the effects of grape seed extract (GSE) on paraoxonase activities in streptozotocin-induced diabetic rats. Our study included four groups of rats: Group I (n = 8), control; Group II (n = 10), GSE-supplemented; Group III (n = 6), streptozotocin-induced diabetic; and Group IV (n = 7), GSE-supplemented diabetic rats. Serum paraoxonase

activities were determined with a spectrophotometric method. Paraoxonase activities in Group III were significantly lower than in the other three groups ($P < .001$, $P < .001$, and $P = .005$ for Groups I, II, and IV, respectively), and Group IV showed increased paraoxonase activities compared to Group III ($P = .005$). This is the first study to show an association between paraoxonase status and GSE supplementation and demonstrated that GSE increased paraoxonase activities. This beneficial effect of GSE was more obvious in the diabetic group, which was more prone to atherosclerotic events compared to the healthy population.

4. References

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