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MINI REVIEW

ANTIOXIDANT POTENTIAL OF GRAPES (VITIS VINIFERA): A REVIEW

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ABSTRACT:

Grapes (Vitis vinifera) are among the most widely consumed fruits and the demand for grapes and grape products is increasing because of the associated health benefits. Grape extracts are industrial derivatives from whole grape that have a great concentration of flavonoids, linoleic acid and polyphenols with known health benefits, due to its high antioxidant capacity. The aim of this present review is to throw light on the antioxidant activity of Grapes seeds (Vitis vinifera).

Keywords: Antioxidant, grape

INTRODUCTION

A large portion of the world population, especially in developing countries depends on the traditional system of medicine for a variety of disease. Several hundred genera are used medicinally, mainly as herbal preparation in the indigenous system of medicine in different countries and are sources of very potent and powerful drugs. Antioxidants are agents which scavenge the free radicals and prevent the damage caused by them. They can greatly reduce the damage due to oxidants by neutralizing the free radicals before they can attack the cells and prevent damage to lipids, proteins, enzymes, carbohydrates and DNA. They play an important role in various fields such as medical field, food industries and others. Antioxidant-based drug formulations are used for the prevention and treatment of complex diseases like atherosclerosis, stroke, diabetes, Alzheimer's disease and cancer. Natural antioxidants that are present in herbs and spices are responsible for inhibiting or preventing the deleterious consequences of oxidative stress. Spices and herbs contain free radical scavengers like polyphenols, flavonoids and phenolic compounds.

Grapes (Vitis vinifera) are among the most widely consumed fruits, and the demand for grapes and grape products is increasing because of the associated health benefits. Grapes are rich in phenolic compounds with approximately 75% of grape polyphenols existing in the skin and seeds. The biological activity of Grapes has been widely investigated, including in vitro, in vivo, and clinical studies. The round , ripe, sweet grapes, were used to treat a range of health problems including cancer ,cholera ,smallpox , nausea, eye infections and skin, kidney and liver diseases. Grape seed is available as a dietary supplement in capsules, tablets and liquid extracts. Among other beneficial effects, the active compounds in Grape are believed to have pharmacological activities such anti-inflammatory [1-2], anticancer [3], antifungal [4], anti-bacteria [5-6] and antioxidant.

Various antioxidant activity methods have been used to monitor and compare the antioxidant activity. In recent years, oxygen radical absorbance capacity assays and enhanced chemiluminescence assays have been used to evaluate antioxidant activity. The different types of methods published in the literature for the determinations of antioxidant activity of foods involve electron spin resonance (ESR) and chemiluminescence methods. Radical scavenging activity of antioxidants against free radicals like the 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical, the superoxide anion radical (O2), the hydroxyl radical (OH), or the peroxyl radical (ROO). The ABTS [2,2'-azinobis(3-ethylbenzothiazoline-6-sulfonic acid)] radical cation has been used to screen the relative radical-scavenging abilities of flavonoids and phenolics.

ANTIOXIDANT POTENTIAL OF GRAPES

Antioxidant activities of grape phenolic compounds have been extensively investigated *in vitro* and *in vivo*. Many scientists reported that grape skin, seed, and pomace extracts possess potent free radical scavenging activities using oxygen radical absorbance capacity. However, the *in vivo* studies examining antioxidant activity of grape extracts have shown inconsistent results. Some studies showed that dietary intake of grape antioxidants helps to prevent lipid oxidation and inhibit the production of reactive oxygen species. Further, the antioxidant potency of grape is proved by various scientists.

Ce et al [7] was to investigate the utilization of grape seed extract as natural antioxidants for retarding lipid and protein oxidation in silver carp fillets stored at 4 ± 1 °C. The results indicate that CBE exhibited higher total phenolic content, DPPH and Fe^{2+}-chelating activity than GSE. They reported that GSE and a 20-times dilution of CBE were found to be effective in retarding lipid and protein oxidation. CBE20 more efficiently inhibited lipid oxidation than did GSE. The antioxidant effect of the two extracts on protein oxidation was less pronounced than the effect on lipid oxidation. CBE20 and GSE could be used as natural antioxidants to minimize lipid and protein oxidation and to extend shelf life of fillets.

Melgarejo-Flores[8] et al evaluated the total phenolic and flavonoid contents and the antioxidant activity using the Trolox equivalent antioxidant capacity and DPPH• radical inhibition methods. The odor acceptability of the treated berries was evaluated after 10 d of storage. The CLO emulsion (5 g L^{-1}) significantly reduced the fungal decay without affecting the antioxidant properties of the berries. All tested concentrations inhibited fungal decay and increased the flavonoid content and antioxidant activity. When CLO was incorporated into the pectin, no fungal decay appeared, and the highest antioxidant activity was observed after 15 d of storage. Additionally, all treatments, except the emulsion treatment, increased the odor acceptability of the treated berries compared to the control berries. They concluded that CLO as vapors or coatings can be used to control decay and increase the antioxidant health benefits of grapes due to CLO's antifungal and antioxidant properties.

Jonathan et al[9] was investigated the effect of grape seeds aqueous extracts on Gram-positive and Gram-negative bacteria and their antioxidant activity. Grape seeds are considered a rich source of polyphenolic compounds that show antioxidant and antimicrobial effects. The antioxidant capacity of the seeds extracts depends on the content of total polyphenol compounds, and this antioxidant activity and antibacterial capacity were observed to be lower when extracts were obtained from seeds after making of wine. The results suggest that the use of grape seed extract is a feasible alternative as antibacterial and antioxidant agents to prevent the deterioration of stored foods by bacteria and oxidation.

Baydar et al[10] extracted Grape seed using different solvent mixtures and assayed for their antioxidant properties. Total phenolic contents of the extracts were determined by the Folin-Ciocalteu method. Antioxidant activities of the extracts at different concentrations were evaluated using the 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging, hydrogen peroxide scavenging and phosphomolybdenum methods. Also the extracts, as natural antioxidants, were assayed during eight weeks storage of refined poppy oil at 70 °C. For this reason peroxide value was used as a criterion to assess the antioxidant activity of grape extracts. The grape seed extracts showed strong antioxidant activity, by measuring their capacity to scavenge DPPH and hydrogen peroxide; to reduce Mo (VI) to Mo (V) and to decrease in the rate of peroxide formation, when compared to bagasse extract. Antioxidant activities of the extracts increased when the extract concentration increased.

Shelly et al[11] evaluated and compared antioxidant properties and phenolic profile of Norton (Vitis aestivalis), Cabernet Franc clone1, and Cabernet Franc clone 313 (Vitis vinifera) grape. All grapes extract exerted remarkable antioxidant activities. Their oxygen radical absorbance capacity (ORAC) values were not significantly different from one another, ranging from 22.9 to 26.7 μmol TE/g of fresh weight. The Cabernet Franc clone1 had the strongest 1,1-diphenyl-2-picrylhydrazyl (DPPH•) radicals scavenging activity (8.8 μmol TE/g) compared to the Norton or Cabernet Franc clone313 grape extracts (7.9 μmol TE/g and 5.4 μmol TE/g, respectively). The Norton grape contained significantly higher total phenolic, anthocyanin, and flavonoid content than the Cabernet Franc grapes ($p < 0.05$). The hydroxybenzoic acids, in particular gallic acid, were the major phenolic acids in all the grape extracts. The Norton grape variety was found to be rich in malvidin-diglucoside and malvidin-glucoside, while the malvidin-diglucoside was negligible in the Cabernet Franc grapes. The results suggest a remarkable impact of grape genotype on its antioxidant properties and phenolic composition in Virginia-grown wine grapes.

Edwin et al[12] determined the antioxidant activity of commercial grape juices in inhibiting the copper-catalyzed oxidation of human low-density lipoproteins (LDL) in vitro and at relating this activity to the phenolic composition of the juices. They also evaluated the effect of vitamin C on this antioxidant activity. When standardized to a total phenolic concentration of 10 íM gallic acid equivalents (GAE), samples of grape juices inhibited LDL oxidation from 62 to 75%. White grape juices inhibited LDL oxidation on the average by 72%, Concord purple grape juice by 67%, and grape juice blends (mixture of white and Concord grape juice) by 63%. Vitamin C had no significant effect on the antioxidant activity of the grape juices tested. The antioxidant activity of Concord juice samples was related to their anthocyanin levels, while that of the white grape juices was related to their levels of flavan-3-ols and hydroxycinnamates, as determined by HPLC. On the basis of the same total phenolic concentration, the antioxidant activity of grape juices toward LDL oxidation was comparable to that of several California red wines.

Ghafoor et al[13] was extracted important functional components from Campbell Early grape seed by ultrasoundassisted extraction (UAE) technology. The experiments were carried out according to a five level, three variable central composite rotatable designs (CCRD). The best possible combinations of ethanol concentration, extraction temperature, and extraction time with the application of ultrasound were obtained for the maximum extraction of phenolic compounds, antioxidant activities, and anthocyanins from grape seed by using response surface methodology (RSM). Process variables had significant effect on the extraction of functional components with extraction time being highly significant for the extraction of phenolics and antioxidants. The optimal conditions obtained by RSM for UAE from grape seed include 53.15% ethanol, 56.03 ^{0}C temperature, and 29.03 min time for the maximum total phenolic compounds (5.44 mg GAE/100 mL); 53.06% ethanol, 60.65 ^{0}C temperature, and 30.58 min time for the maximum antioxidant activity (12.31 mg/mL); and 52.35% ethanol, 55.13 ^{0}C temperature, and 29.49 min time for the maximum total anthocyanins (2.28 mg/mL). Under the above-mentioned conditions, the experimental total phenolics were 5.41 mg GAE/100 mL, antioxidant activity was 12.28 mg/mL, and total anthocyanins were 2.29 mg/mL of the grape seed extract, which is well matched with the predicted values.

Yilmaz and Toledo[14] reported that grape seeds and skins are good sources of phytochemicals such as gallic acid, catechin, and epicatechin and are suitable raw materials for the production of antioxidative dietary supplements. The differences in levels of the major monomeric flavanols and phenolic acids in seeds and skins from grapes of Vitis vinifera varieties Merlot and Chardonnay and in seeds from grapes of Vitis rotundifolia variety Muscadine were determined, and the antioxidant activities of these components were assessed. The contribution of the major monomeric flavonols and phenolic acid to the total antioxidant capacity of grape seeds and skins was also determined. Gallic acid, monomeric catechin, and epicatechin concentrations were 99, 12, and 96 mg/100 g of dry matter (dm) in Muscadine seeds, 15, 358, and 421 mg/100 g of dm in Chardonnay seeds, and 10, 127, and 115 mg/100 g of dm in Merlot seeds, respectively. Concentrations of these three compounds were lower in winery byproduct grape skins than in seeds. These three major phenolic constituents of grape seeds contributed <26% to the antioxidant capacity measured as ORAC on the basis of the corrected concentrations of gallic acid, catechin, and epicatechin in grape byproducts. Peroxyl radical scavenging activities of phenolics present in grape seeds or skins in decreasing order were resveratrol > catechin > epicatechin = gallocatechin > gallic acid = ellagic acid. The results indicated that dimeric, trimeric, oligomeric, or polymeric procyanidins account for most of the superior antioxidant capacity of grape seeds.

Ghafoor et al[15] was applied supercritical fluid extraction (SFE) technique and optimized for temperature, CO_2 pressure and ethanol concentration using orthogonal array design and response surface methodology for the extract yield, total phenols and antioxidants from grape (Vitis labrusca B.) seeds. Effects of extraction temperature and pressure were found to be significant for all these response variables in SFE process. They found that the antiradical assay showed that SFE extracts of grape seeds can scavenge more than 85 % of 1, 1-diphenyl-2-picrylhydrazyl (DPPH) radicals. The grape seeds extracts were also analyzed for hydroxybenzoic acids which included gallic acid (1.21 ~ 3.84 μg/ml), protocatechuic acid (3.57 ~ 11.78 μg/ml) and p-hydroxybenzoic acid (206.72 ~ 688.18 μg/ml).

CONCLUSION

The data presented here indicates that the marked antioxidant activity of grapes extracts that contains large amounts of flavonoids and phenolic compounds, may act in a similar fashion as reductones by donating the electrons and reacting with free radicals to convert them into more stable product and terminate free radical chain reaction. The potential use of grape skin and seed extracts in antioxidant activity has great potential.

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