# Antioxidant Properties of Medicinal Plant: A Review

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**Abstract: Oxidation is an essential component of aerobic activities in life. It is the transfer of electrons or hydrogen from a substance to an oxidizing agent via a chemical process, which results in the formation of free radicals. These extremely reactive free radicals set off a chain reaction that causes cellular damage. The genesis of cancer disorders has been connected to the production of free radicals that exceed the body's antioxidant capacity, causing oxidative stress. As a result, study has shifted to plants, which contain antioxidants that can scavenge and disrupt the detrimental effects of free radicals. A vast collection of compounds produced by plants known as phytochemicals, which have strong antioxidant qualities, have been shown to be beneficial in the treatment of a variety of ailments. This review focuses on the antioxidant potential of plants with medicinal capabilities, which can benefit individuals, companies, and health institutions.**

**Keywords: Antioxidant activity, phytochemical, Medicinal plant, free radical, Antioxidant mechanism**

**Introduction:**

In the process of cellular oxygen reduction during ATP production, by-products known as reactive oxygen species (ROS) are formed in the human body. Among ROS, free radicals, such as OH or O2, can be distinguished [1]. ROS can also come from exogenous sources such as smoking or environmental pollutants. The accumulation of ROS in the human body results in a redox imbalance. This leads to damage to many cellular structures, which can result in the disruption of cellular homeostasis [2,3].

Hence, when there is an imbalance between the ROS and endogenous antioxidants, exogenous antioxidants taken with food can be an effective factor in the fight against free radicals. Excellent alternative sources of natural antioxidants are plant products, such as fruits, vegetables and herbs. [4,5,6,7].

Antioxidants are chemicals that dispose free radical species, scavenge them, suppress their synthesis of formation of those free radicals, or oppose their action. There is an optimal pro-oxidant: Antioxidant equilibrium in a normal cell. When the production of oxygen species is boosted or antioxidant levels are depleted, however this equilibrium can be changed towards the pro-oxidant. This is referred to as “oxidative stress,” and it can cause substantial cell damage if the stress is severe or continuous. Oral Squamous Cell Carcinoma (OSCC), the most prevalent oral cancer, has a wide spectrum of clinical symptoms and accounts for more than 90% of all oral malignancies [8].

Exogenous and endogenous antioxidants typically work together to achieve a balance between antioxidation protection and oxidant generation, which is thought to be vital in maintaining a healthy biological system [9].

Plants contain various antioxidants, which assist to give protection against free radical-associated diseases [ 36]. Phytochemicals are literally 'plant-chemicals.' They are non-nutritive chemical components of plants that provide numerous health advantages and disease prevention qualities.[37 ] They include nonessential nutrients, which means the body does not require them to sustain life.[38] Plants produce t hese compounds to support life, and they provide health advantages to people when consumed.[39,40] More than a th ousand phytochemicals have been identified and classed as principal or secondary ingredients depending on their func tion in plant metabolism.[41]Polyphenols are the most common dietary phenolics, consisting of hydrolysable and condensed tannins, phenolic acids (hydroxybenzoic and hydroxycinnamic acids), and flavonoids. Flavonoids are the most thoroughly investigated type of polyphenol.[42] Polyphenols are mostly found in legumes (pulses and beans), cereals (corn, barley, oats, sorghum, rice, and wheat), nuts, oilseeds (rapeseed, flaxseed, olive seeds, and canola), beverages (fruit juices, tea, coffee, beer, wine, and cocoa), and fruits and vegetables.[43] Phenols are classified into three subclasses: flavones, flavanols, and minor flavonoids. They demonstrate antioxidant activity by inhibiting the decomposition of hydroperoxide into free radicals and inactivating free radicals. Flavonoids serve an important function in avoiding diseases caused by oxidative stress. It can lower alpha tocopherol radicals, inhibit oxidases, activate antioxidant enzymes, and chelate metals in addition to carrying electrons to free radicals.[44] They aid in the inhibition of the ACE, an enzyme that increases blood pressure. Additionally, they have been shown to inhibit cyclooxygenase,

which is known to make prostaglandin, and prevent enzymes that produce estrogen, which has been linked to breast cancer.

**Medicinal plants with antioxidant potential**

Conversely, antioxidants possess the ability to neutralize free radicals that originate from both internal and external sources. [45-47] Plants possess inherent antioxidant and radical-scavenging abilities.[48] Numerous components found in plants shield cells against harm brought on by free radicals. Phenols and flavonoids are the primary components of plants with therapeutic use and antioxidant capabilities. Because of their structure, these components can scavenge these free radicals.

Phenolic compounds are a class of secondary metabolites that have potent free radical scavenging activity, inhibit hydrolytic and oxidative enzymes, and have anti-inflammatory properties.[49] Flavonoids are a class of phenolic compounds with a variety of beneficial properties, including the ability to scavenge a wide range of oxygen, chlorine, and nitrogen species such as hydroxyl ions, peroxynitrous acid, superoxide, reactive oxygen, peroxylradicals[50], and hypochlorous acid, as well as the ability to chelate ions by reducing the pro-oxidant capacity of metal ions.[51]Antioxidant chemicals vary in polarity.

**1.Asparagus racemosus linn (shatavari)**

Synonym: Satavar, shatavari, shatamull[10].

Family: Asparagaceae

Chemical constituents: Asparagus are a group of steroidal saponins. It also consists number of vitamins such as A, B1, B2, C, E, Mg, P, Ca, Fe and folic acid. Other constituents of asparagus are essential oils, asparagine, arginine, tyrosine, flavonoids (kaempferol, quercetin and rutin), resin and tannin [11].

Fig 1a: Asparagus racemosus roots

Fig1b: Asparagus racemosus leaves

Medicinal and antioxidant property: The crude drugs of asparagus roots are mainly used for increasing the secretion of milk and for improve the appetite in lactating women. It's also useful in dysentery, tumors, inflammation, biliousness, leprosy, epilepsy, and night blindness. In unani system roots are used as laxatives, tonic, aphrodisiac, galactagogue and in disease of kidney and liver. Asparagus racem- osus are also used against jaundice. It is widely used as antioxidant, anti-stress effect, anti-ulcer, and wound healing property. Antioxidant properties of this plant have become a vast interest due to their possible uses as natural additives to substitute synthetic ones. Thus, the result obtained in the present study showed that the methonolic extract of the root of Asparagus racemosus contains the maximum antioxidant compound which can scavenge different Reactive Oxygen Species (ROS) and free radicals under in vitro conditions[11,12,13].

**2. Glycyrrhizaglabra**

Synonym: Liquorice, black sugar

Family: Fabaceae

Chemical constituents: The triterpene saponins are the major characteristic constituents of liquorice, being responsible for sweet taste. Glycyrrhizin, glycyrrhiric acid, yellow colour is due to flavonoid content such as flavanones, flavones, flavanonols, chalcones, isoflavans, isoflavenes, isoflavones and isoflavanones.The major flavonoids are glucosides of liguiritigenin and isoliquiritigenin such as liquirtin, isoliquiritin, liquiritin apioside and licuraside. Some phenolic compounds are also present. Many volatile components are geraniol, pentanol, hexanol, teroinen-4-ol and α-terpineol. G. glabra is also rich in propionic acid, benzoic acid, furfuraldehyde, 2,3-butanediol, furfuryl formate, maltol, 1-methyl-2-formylpyrrole and trimethylpyrazine[14].

Fig 2a:Glycyrrhiza glabra bark

Fig 2b: Glycyrrhiza glabra Flowers

Medicinal and antioxidant property: The extracts are used in food and pharmaceutical industries, also in the manufacture of functional foods and food supplements. It's also used as traditional Chinese medicine; it's used for the treatment of gastrointestinal problems, cough, bronchitis, and arthritis and widely used to treat gastritis, peptic ulcers, respiratory infections, and tremors in folk medicine. Used as food additives that is as flavors and sweetening agents and used as flavoring agent for American type tobacco, chewing gum, candies, baked goods, ice cream, and soft drinks. It's also used as beer and fire extinguishers, and skin depigmentation agent (Figures 3a and 3b). Total antioxidant activity determination by ferric thiocyanate method, Ferric cyanide (Fe3+) Reducing Antioxidant Power assay (FRAP), Cupric Ions (Cu2+) reducing power-cupric assay, chelating activity on ferrous ions (Fe2+), hydrogen peroxide scavenging activity, DPPH free radical scavenging activity, ABTS radical decolourization assay, superoxide anion radical scavenging activity, measurement of DMPD and scavenging ability [15].

**3. Zingiber officinale (ginger)**

Synonym: Ginger

Family: Zingiberaceae

Chemical constituents: Ginger rhizomes consist of carbohydrates, lipids, terpenes and phenolic compounds. Terpene includes zingiberene, β-bisabolene, α-farneses, β-sesquiphellandrene, and α-curcumene some phenolic components are gingerols, paradols, and shogaol found in large quantity. Other shagol related compounds include 6-paradol, 1-dehydrogingerdione, 6-gingerdione, 10-gingerdione, 4-gingerdiol, 6-gingerdiol, 8-gingerdiol and 10-gingerdiol and diarylheptanoids [16,17].

Fig 3a: Zingiber officinale root

Fig 3b: Zingiber officinale Flowers

Medicinal and antioxidant property: It helps to reduce nausea, prevent nausea due to chemotheraoy, motion sickness, and surgery. It's also essential remedy for nausea during pregnancy. It's widely used for various GI problems such as morning sickness, colic, upset stomach, gas, bloating, heartburn, flatulence, diarrhea, loss of appetite, and dyspepsia. Other uses are pain relief for arthritis, muscle soreness, chest pain, low back pain, stomach pain and menstrual pain; treat upper respiratory tract infections, cough, and bronchitis and anti-inflammatory agent, lowers blood pressure (Figures 6a and 6b). It also used in treatment of cold and flu. The anti-oxidant capabilities of ginger (Zingiber officinale) were assessed using three parameters: Antioxidant capacity, total phenolic and flavonoid content, and phenolic acid identification in Water Extract (WEG) and Ethanol Extract (EEG). FRAP, CUPRAC assay, Fe2+ chelating ability, DPPH and DMPD radical scavenging activities were used to determine antioxidant capacity. Folin Ciocalteu's technique was also used to determine total phenolic and flavonoid content in both extracts. The HPLC-MS/MS method was used to identify the phenolic acids. In all experiments, the data showed that EEG had higher antioxidant activity than WEG. In all experiments, the data showed that EEG had higher antioxidant activity than WEG. According to

HPLC-MS/MS study, ginger contains at least eight distinct phenolic acids, with pyrogallol p-hydroxybenzoic acid, ferulic acid, and p-coumaric acid being the most prevalent in both extracts. This study clearly proved that ginger extracts have potent antioxidant activities, and that their consumption can help to prevent or delay the onset of diseases caused by oxidative stress in the absence of antioxidant supplements [17].

**4.Benincasa hispida**

Synonym: Ash gourd, white gourd [19].

Family: Curcurbitaceae

Chemical constituents: Benincasa hispida fruits contains volatile oils, flavonoids, glycosides, sacchrides, proteins, carotenes, vitamins, minerals, β-sitosterin and uronic acid [20].

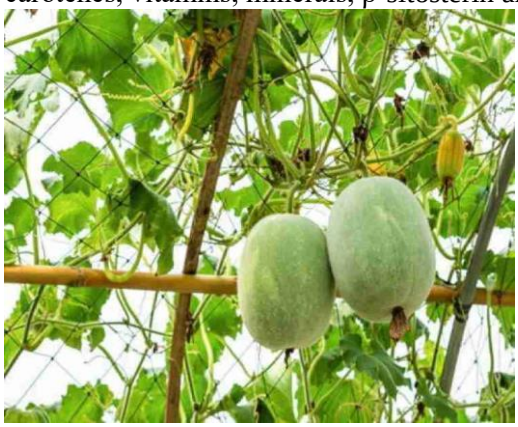

Fig 4a: Benincasa hispida fruit

Fig 4b: Benincasa hispida Flower

Medical and antioxidant properties: It is used for gastrointestinal problems, respiratory disease, heart diseases, diabetes mellitus and urinary diseases. Fruits were traditionally used as a laxative, diuretic, tonic, aphrodisiac, cardiotonic, jaundice, dyspepsia, fever and mental disorders. It's mainly used in treatment of central nervous effects such as anxiolytic, musle relaxant, and antidepressant, in treatment of Alzheimer's disesase and to minimize opiates withdrawal signs. It shows antioxidant, antidepressant, anti-inflammatory, analgesic, antiasthmatic, diuretic, nephroprotective, antidiabetic, hypolipidemic and antimicrobial effects (Figure 10). The total phenolic content (CSF) denotes the antioxidant activity whereas DPPH and ABTS denote scavenging activity. The ethanolic extract gives the highest ethanolic content and antioxidant activity [21,22].

**5. Bauhinia purpurea (l) bark**

Synonym: Orchid tree, purple bauhinia, camel's foot [23].

Family: Fabaceae

Chemical constituents: Flavonoids, alkaloids, steroids, triterpenoids, fatty alcohol, acid, and aster, glycerol's, phenols chromone, sugar [24].

Fig 5: Bauhinia purpurea Flower

antimalarial, antifungal, antimycobacterium, antimicrobial, anti-diarrheal, antiepileptic, antioxidant, anti-ulcer, anti-hyperlippidemic, anti-cancer, anti-obesity, hepatoprotective, cytotoxic, amelioration of hyperthyroidism, fibrolytic, anti-inflammatory and anti-arthritic activity, wound healing, nephroprotective. The antioxidant activity was measured

by 2,2-diphenyl-1-picrylhydroxyl solution (DPPH) radical scavenging assay and the in vitro studies showed considerably antioxidant activity, mainly based a scavenging of oxygen radicals. These flavonoids mainly inhibit of low-density lipoproteins oxidation, likely due to their reductive capacity and protein-binding properties. Hence Bauhinia purpurea are to be claimed as good antioxidant properties [25,26].

**6.Cocculus hirsutus**

Synonym: Broom creeper, Patalgarudi (India biodiversity, 2021)

Family: Menispermaceae

Chemical constituents: Alkaloids such as Jasminitine, Hirsutine, cohirsitine and their derivatives flavonoids like rutin, liquiritin, and quercetin terpentine derivatives like Hirsutus were reported same such constituents such as β-sitosterol and 28-acetylbotulin. And by preliminary pytochemical screening of the extract's carbohydrates, steroids, alkaloids, glycosides, flavonoids, tannins and saponins were determined [27,28].

Fig 6: Cocculus hirsutus Fruit

Medicinal and antioxidant property: Its juice with sesame oil is applied on head to reduce the heat, treat stomach heat, blood dysentery. Prurigo, impetigo, eczema, ulcers, cuts, wounds, and other skin conditions are treated with the leaves. Urinary problems, fever, leucorrhoea, and acute gonorrhea are all treated with the leaves. Conjunctivitis and other eye problems can be treated using the leaves and stems. Dysentery and diarrhea are treated by taking the leaf powder orally. Stomach problems are treated using the stem. The bitter, alterative, and laxative roots are used to treat fevers, skin irritations, rheumatism, gout, syphilitic cachexia, and stomachaches in children. The stems and roots extract is used as a sedative, hypotensive, cardiotonic, and anti-inflammatory agent. These fruits of Cocculus hirsutus (L) Diels was extracted with acidified methanol and used for phytochemicals and antioxidant activity analysis This compound possess beneficial health properties like antioxidant activity, free radical scavengers, protective effect against cardiovascular diseases, anti-inflammatory and anticarcinogenesis properties. Some fruits are good source of natural antioxidants including carotenoids, vitamins, phenols, flavonoids, dietary glucothionine and endogeneous metabolites and high level antioxidant capacity against free radical species, superoxide radicals, hydrogen peroxides, nitric oxide and hydroxy radicals. These natural anti-oxidant activities of fruits induce reduction of disease in human, protein against tourn development [29].

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