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NATURAL ANTIOXIDANTS IN MEDICINAL PLANTS: A REVIEW

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Abstract

Ayurvedic remedies are frequently tailored to the needs of the individual. Ayurvedic Indian and traditional Chinese systems are live "great traditions" that play major roles in bio prospecting for new medications derived from medicinal plants, which are also high in antioxidants. Antioxidants are compounds that promote cell protection from free radical damage. Plants generate a significant quantity of antioxidants, making them an effective basis of antioxidant molecules. Compounds found in the body and a variety of foods can react with free radicals to quench or inactivate them, protecting them from harming cells. They have the ability to boost blood antioxidant capacity. In response to increased human risk factors for a variety of deadly diseases, a consensus has evolved in favor of using natural compounds found in medicinal and food plants as therapeutic antioxidants. According to research, the consumption of antioxidant-rich foods and medicinal plants has an inverse correlation with the prevalence of human diseases. Many researches are looking at the various health usefulness of antioxidant supplements in functions such as stress, aging, pathogen infestation, reducing cell harmful effects, apoptosis, and free radical-related neurological illnesses. Certain secondary antioxidants, such as Glutathione reductase, reduce oxidation, butylated hydroxytoluene (BHT), glutathione-s-transferase, glucose-6-phosphate dehydrogenase, ubiquinone and butylated hydroxyanisole (BHA) as well, but they have been linked to human health risks. As a result, in recent years, research for non-toxic antioxidants has increased.

Key words: Primary antioxidants, Secondary antioxidant, Free radical, Medicinal plant

Introduction

Plants and their derivatives have been used as herbal supplements, nutraceuticals, and pharmaceuticals throughout human history (Ekor, 2014). For the treatment of common ailments, approximately 60–80 percent of the world's civilization still utilizes conventional medicine (Ravishankar & Shukla, 2007). Folk medicine is used as a primary health care source, with accessibility, price, and cultural beliefs being the main reasons for its use (Tag et al., 2012; Benzie & Wachtel-Galor, 2011). Plants have been discovered to be extremely important because of their medical and nutritional characteristics, as well as their primary supply of bioactive substances.

Natural antioxidant efficacy is influenced by plant genetics, extraction, and the growing environment. The method of action for these compounds varies depending on the origin material, synergistic, the existence of antagonists, and, of course, the food matrix to which they are applied. To boost the use of herbal medicine and to find out their possible source of unique medications, it is expected to examine therapeutic plants with belief positions in a variety of more intensive ways (Said et al., 2002).

Herbal medicine is now one of the most significant areas of folk medicine, and herbal medicines are becoming increasingly popular for a variety of ailments. The comparison of phytochemicals extracted from plants and their pharmacological effects is becoming increasingly popular (George & Joseph, 2009). The therapeutic characteristics of the plant have been assessed on the basis of current systematic developments in the world due to it's low toxicity, beneficial pharmacological activities, and economic viability . Flavonoids, phenols, sterols, and alkaloids are just a few of the bioactive molecules found in plants that have antioxidant properties.

Free radicals

Free radicals are a necessary component of any biochemical process and are an important feature of aerobic life and metabolism. A free radical is an atom or molecule with a lone pair of electrons that is chemically reactive and capable of rapid chain reactions that destabilize other molecules and generate a large number of free radicals. Most radicals are highly reactive and unstable, allowing them to give or absorb an electron from a nearby molecule, allowing them to operate as oxidants or reductants. Free radicals have half-lives measured in milliseconds, microseconds, or nanoseconds in general (Cheeseman & Slater, 1993). They can be reactive sulfur species, reactive oxygen species, which are formed from oxygen, or reactive nitrogen species, which are derived from nitrogen. RO (alkoxyl), O2 (superoxide), HO2 (hydroperoxyl), HO (hydroxyl), ROO (peroxyl), NO2 (nitrogen dioxide), N2O3 (dinitrogen trioxide) and NO (nitric oxide) are the most common nitrogen-derived free radicals (Devasagayam & Kesavan, 1996). The majority of diseases are caused by oxidative stress caused by free radicals, antioxidant deficiency or reactive sulfur species (Velavan et al., 2007).

Antioxidant

Antioxidant protective tools in the form of biological enzymatic and non-enzymatic functions have been discovered in the human body to neutralize the damaging consequence of free radicals, reactive sulfur species and other oxidants (Alam et al., 2013). Neural disorders, cardiovascular disease, tissue damage, cancer, atherosclerosis, central nervous system injury, inflammation, obesity, arthritis, and ageing are all linked to free radicals (Köse et al.,2015; Gülçin et al.,2010).

Antioxidants in plants have recently been shown to reduce the damage caused by free radicals by inhibiting electron transport (Liochev, 2013) and have pharmacological benefits, including apoptosis, gene expressionanticarcinogenic, free radical scavenging, antiallergic, antimutagenic, antibacterial, ion transportation, and antidiabetic characteristics (Puertollano et al., 2011; Lü et al., 2009: Pinchuk et al., 2012). To counteract oxidative stress, plants and humans have complex systems of redundant antioxidants, such as glutathione. Physiological functioning may deteriorate when the antioxidant defense is weakened owing to a range of factors, resulting in many diseases and aging. To avoid the harm effected by oxidation, however, a supply of antioxidants and antioxidant-containing foods is required (Halliwell & Gutteridge, 2003).

Type of antioxidants:
Antioxidants can be categorized into three types:

1. Primary antioxidants: Antioxidants that participate in the chain breaking system and react with lipid radicals to transform them into safer particles. The majority of the antioxidants in

this group are phenolic in nature. Because these antioxidants are cofactors of antioxidant enzymes, their absence may have an impact on macromolecule metabolism, particularly glucose metabolism.
2. Secondary antioxidants: These antioxidants are phenolic chemicals that play a role in stopping chain reactions and binding free radicals. Butylated hydroxytoluene (BHT), metal chelating agent (EDTA), glutathione-s-transferase, dehydrogenase, propyl gallate (PG), ubiquinone, butylated hydroxyl anisole (BHA), nordihydro guaretic acid, glucose-6-phosphate and tertiary butyl hydroquinone (TBHQ) are all examples of this group.
3. Tertiary antioxidants: These antioxidants, such as methionine sulfoxide, reductase, and DNA repair enzymes, help to repair biomolecules that have been damaged by free radicals (Nagar et al., 2017).

Antioxidants can also be classified into two groups. These are
1. Enzymatic antioxidants: These are antioxidants that have a role in the body's defense against free radicals and reactive oxygen species, either directly or indirectly. Enzymatic antioxidants comprise glutathione, superoxide dismutase (SOD), peroxidase, catalase, and others (Mehta & Gowder, 2015).

2. Non-enzymatic antioxidants: Dietary sources of antioxidants contain carotenoids, polyphenols, organosulfural, vitamins, compounds, and minerals. The largest class of antioxidants is polyphenols, which includes flavonoids, organosulfural, and phenolic acids (Bunaciu et al., 2016).
Antioxidants are divided into three categories based on their line of defense mechanism:
a. Minerals like selenium, copper, and zinc, as well as superoxide catalase (CAT), dismutase (SOD), and glutathione reductase (GR), may be found in first-line antioxidants.
b. Second-line antioxidants include albumin, glutathione (GSH), flavonoids, vitamin C, carotenoids, vitamin E and others.
c. Damaged DNA rehabilitates enzymes such as transferases, reductases, methionine sulphoxide and others, as well as deteriorated proteins, peroxides, and oxidized lipids, which are all part of the third line of antioxidants (Irshad & Chaudhuri, 2002).

Any antioxidant preparation used in food must be safe, be heat stable, simple to include, productive at intense concentrations, have no flavor, unpleasant odor, or color, and provide a financial advantage.

Means of antioxidants activity

Antioxidants are hypothesized to work in two different ways. To begin with, in a chain-breaking mechanism, the main antioxidant transfers one electron to the system's free radical. The process also involves the use of a quenching chain-initiating catalyst to eliminate reactive nitrogen species initiators (secondary antioxidants)/ROS. Other antioxidant methods, such as co-antioxidants, electron donation, metal ion chelation, or gene expression modulation, are effective in biological systems (Lobo et al., 2010).

Function of Antioxidants in human body

To protect the body's cells and organs from free radicals (ROS), a complex system has evolved in the human body, involving a mixture of endogenous and exogenous components that interact and synergize to minimize the effects of free radicals. These are the ones.

1. Vitamin E, carotenoids, vitamin C, vitamin B and other low molecular weight compounds including lipoid acid and glutathione are all sources of antioxidants.

2. Glutathione peroxidase, glutathione reductase and superoxide dismutase are enzyme antioxidants that catalyze free radical quenching processes.

3. Ferritin, lactoferrin, ceruloplasmin and albumin are proteins that bind metals and capture free iron and copper ions, allowing them to catalyze oxidative processes.

4. A number of other antioxidant phytonutrients exist in a large diversity of plant foods (Sunil, 2014).

Antioxidants from dietary food

The consumption of fruits and vegetables on a regular basis has been shown to reduce the risk of chronic illnesses. People obtain antioxidant supplements directly from fresh vegetables and fruits, which contain a high concentration of antioxidant supplements and flavonoids that can aid in the defense mechanisms against a variety of cardiovascular disorders, as well as malignancies and other health problems (Hamid et al., 2010).

Studies show that a diet high in antioxidants has a large-scale positive impact on health. Antioxidants have been found in a wide range of plants and plant parts, including spinach, strawberries, grapes, plums, blueberries, broccoli blossoms, alfalfa sprouts, and many more, and they are also found in many dietary ingredients.
Citrus fruits, such as lemons and oranges, are also strong in natural antioxidants, particularly vitamin C. (Cao et al., 1998).
In addition, certain new and distinct antioxidants, such as flavonoid derivatives and pcoumaric acid, have been identified in spinach. The natural antioxidant p-coumaric acid and flavonoid derivatives derived from spinach have been shown to have a biological effect on the prevention of prostate cancer. Fruits like araticudomato, jack fruit and pindo palm have recently been revised as good sources of vitamin A, vitamin C, vitamin E, hydroxycinnamic acid and hydroxybenzoic acid. Research is being conducted on these fruits to create biological, chemical, or genetic variations in order to improve the antioxidant ability of the similar (Shebis et al., 2013).

Antioxidant from plants

Antioxidants, both natural and synthetic, are frequently utilized in foods and medicine, mostly those comprising fats and oils, to preserve the food against deterioration. Butylated hydroxyanisole (BHA), natural and synthetic food antioxidants, and butylated hydroxytoluene (BHT) have been mostly utilized in the therapeutic cosmetic and food industries. Nevertheless, customers' preferences led to a shift in producers' or manufacturers' selection of natural antioxidants over man-made antioxidants due to their instability at high temperatures, high volatility, and carcinogenic behavior (Papas, 1999).

In light of the rising risk of humans contracting numerous terminal diseases, there has been a worldwide direction toward using natural compounds found in dietary and medicinal

plants as therapeutic antioxidants. Antioxidant activity has been observed in a range of therapeutic herbs, including Allium sativum, according to Zingiber authorities. Numerous antioxidants, also known as active oxygen scavengers or free radicals, that are obtained naturally from plant sources and are used for food, cosmetics, and remedial purposes, have proven to be excellent alternatives to man-made antioxidants due to their absence of toxic effects on the human body and are inexpensive. Plants have a well-developed enzymatic and non-enzymatic scavenging strategy to combat the negative impacts of reactive oxygen species. Glutathione reductase, Catalase, superoxide dismutase, carotenoids, peroxidases, dehydroascorbate reductase, glutathione peroxidase. Glutathione, tocopherols, and ascorbate peroxidase are non-enzymatic molecules. In distinct organelles of plant cells, there are unmistakable, well-synchronized scavenging systems and ROS production. Lesser degrees of ROS comparatively act as signalling essences that arouse abiotic stress tolerance by altering the manifestation of resistant genes. In plants, elevated degrees of antioxidants have been accounted for to demonstrate better resistance to various types of environmental stresses (Hossain et al., 2012). Lower amounts of ROS, on the other hand, operate as signaling essences, modifying the expression of resistance genes to elicit abiotic stress tolerance. Increased antioxidant levels in plants have been linked to increased resilience to several forms of environmental stressors (Hasanuzzaman et al., 2012).

conclusion

The essential means of underlying a number of human neurological illnesses, autoimmune pathologies, inflammation, viral infections, digestive system and diabetes problems appears to be cellular damage caused by reactive nitrogen species (RNA), reactive oxygen species (ROS) and reactive sulfur species (RSS) production, or free radicals. Reactive sulfur species (RSS), Reactive oxygen species and free radicals are involved in various illnesses, according to a significant number of experimental studies. To combat these disorders, several man-made antioxidants are utilized in processed diets, but they have adverse effects. Several natural antioxidants may be useful in reducing the negative consequences of oxidative stress. As a result, estimating the antioxidant capacity of meals, botanicals, and other nutritional antioxidant supplements has received a lot of interest. Some medicinal plants, such as Dodonaea viscosa, Barleria noctiflora, and Allium sativum, have been shown to have high antioxidant capabilities because they comprise a huge amount of bioactive components such as carotenes, flavonoids carotenoids and phenolics. These chemicals have anti-diabetic, antibacterial, antifungal, anti-spasmodic, anticarcinogenic and anti-inflammatory, properties in addition to antioxidant action.

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