



Clinical Practices of Herbal Antioxidant: A Review

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Abstract: Antioxidant is a magical term in and of itself. The real competition is on to find the newest and most effective mixture of free-radical scavenging chemicals, with the antioxidant concept functioning as a frontline for avoiding so-called “free-radical” activities. DNA/RNA, glucose, trans fats, protein, including micronutrients like carotenoid (α & β carotene, lycopene), vitamins A, B6, B12 and folate have all been scientifically proved to be destroyed by such “radicals”. Enzymes, antioxidants found naturally in the human body (such as glutathione, uric acid, ubiquinol-10 as well as a variety of others), radical-scavenging compounds like vitamin A, C and E, as well as carotenoid, provide a powerful defence against these hostile radical species. This article provide short overview of several recognized and lesser-known herbs which may help to optimise antioxidant levels and

therefore, provide additional preventative benefits for general health. It's important to notice immediately that antioxidants have a wide variety of free-radical quenching effects and each one may be attracted to

various parts of the cell. The mixture of several carotenoids in the retina's macular region, where beta-carotene is totally absent, contributes to the carotenoid's specialised nature.

INTRODUCTION

Herbs as well as spices have usually been characterized as any component of a plant that may be consumed for its fragrant qualities but has not any or little nutritional value^[1]. Herbs and spices, on the other hand, have lately been discovered as sources of a variety of phytochemicals, many of which have potent antioxidant properties^[2]. Herbs may therefore have a role in antioxidant defence as well as redox signaling^[3].

As scientific study advances, it is possible that more carotenoids may be found that have site-specific attractions and activities. This will clarify why we don't have to reject one type of antioxidant molecule in order to accept another. Even while they may congregate in specialised cells and tissues, providing some overlying protection, we need a diverse population of them in order to offer the most overall protection. Antioxidants, interestingly enough, function in tandem with meals. Carotenoids interact with vitamins E and C, he and colleagues have demonstrated. Although when vitamin E levels are low, beta-carotene has been proven to protect LDL cholesterol from oxidative damage^[4]. Throughout this way, antioxidants work together to provide a wide range of protection rather than focusing on a particular aspect of the spectrum. Plant antioxidants such as phenols and bioflavonoids, among others have been shown to enhance the antioxidant activity of vitamin A. Because rutin, a bioflavonoid, enhances the antioxidant activity of vitamins C and E, the antioxidant effect becomes even more strong. To put it another way, adding a third antioxidant (rutin) boosts the overall impact^[4].

Some of the most potent antioxidant plants: Component nutrients that have been shown to have radical-scavenging abilities as well as non-vitamin and mineral compounds with antioxidant capabilities, make up plant antioxidant factors. Flavonoids, polyphenols and flavoproteins in connection to alpha-tocopherol, sodium ascorbate, carotenoid and zinc are examples of plant-based medicines. Aside from that, certain plants or combinations of herbs in compositions may function as antioxidants by scavenging superoxide or boosting superoxide dismutase activity in different tissues^[5]. These are chemicals that have the power to protect cells via a range of molecular mechanisms. A range of plants, including fruits, vegetables and commonly used spices and herbs, include cancer-fighting chemicals in addition to antioxidants. Polyphenols, thiols, carotenoids and retinoids, as well as carbohydrates, trace metals, terpenes

and tocopherols and glucosinolate breakdown products (isothiocyanates, indoles and dithiothiols), may be classified into a number of categories depending on their chemical structure. These are substances that, via a variety of biochemical processes, have the ability to protect against cancer. Carcinogenesis biochemical processes are yet unknown in their whole and they are expected to differ depending on the kind of cancer. As a result, in order for cancer-protective medicines to be successful, a simplified model of carcinogenesis must be used to describe the biochemical backdrops for their actions. This briefing presents a generalised initiation-promotion-conversion framework in which initiators are thought to be genotoxic either directly or indirectly, promoters are thought to be substances capable of conferring an advantage on initiated cells and converters, such as genotoxicity, clastogens and recombinogens are thought to be genotoxic. According to the National Cancer Institute, in addition to scavenging mutagens and carcinogens, carotenoids quench singlet oxygen and radicals as well as the antioxidant effects of several compounds like ascorbic acid and polyphenols. Cancer-protective agents found in fruits and vegetables also inhibit the activity of activating enzymes. Biological mechanisms in antipromotion include the antioxidant effects of carotenoids and polyphenols, the stimulation of immunological responses by carotenoid and ascorbic acid and the inhibition of ornithine decarboxylase by polyphenols and carotenoids. Many initiator inhibitors may also be transformation inhibitors. Cancer prevention and inhibition are discussed^[5] with a focus on fruits and vegetables. Antioxidants produced from plants are more than just a backup plan when it comes to combating cellular damage and illness. Some plants, according to folklore, are capable of fulfilling specific functions in the prevention and treatment of disease. Silymarin, a well-known hepatoprotective antioxidant derived from milk thistle (*Silybum marianum*), reduces liver damage via a number of mechanisms^[6] [including free radical scavenging]. Amanita phalloides is a fungus that contains highly poisonous chemicals that protect the liver against the effects of alcohol and pharmaceuticals as well as poisoning and other types of injury or sickness. Given the literature on the topic, the finding that amanita poisons are not eliminated by free radical scavenging is unexpected. Instead, it's thought that silymarin and amanita toxins compete for the same membrane receptor^[6]. Milk thistle has been used in traditional medicine for over 2000 years to protect the liver. Modern laboratory research backs up and clarifies these advantages.

Herbs that have antioxidant effects

Ginger: Botanical name: *Zingiber officinale*; the common parts that are used: Rhizome. Recommended Dosage is : 1 ounce of rhizome to 1 pint of water. Set aside 5-20 min to immerse the plant material in boiling water. Drink 1 to 2 cups each day, hot or warm. Ginger is currently gaining popularity as a treatment for motion sickness nausea. Ginger tea has long been used in the United States to treat coughs and asthma caused by allergies or inflammation. The old folklore use of this plant resulted in the production of ginger ale, a popular beverage for nausea and other stomach problems. Ginger has historically been used to alleviate headaches and toothaches because of its rubefacient properties. Ginger's anti-inflammatory effect is mediated by a mechanism similar to that of a non-steroidal anti-inflammatory medication. This popular spice is a more physiologically potent prostaglandin inhibitor than onion and garlic (through cyclo-oxygenase inhibition). An inflammatory reaction is slowed by slowing related metabolic processes. In one research, Danish women aged 25-65 ingested either 70 g of raw onion or 5 g of raw ginger everyday for a week. The author discovered that ginger, rather than onion, had a significant impact on thromboxane production, decreasing it by >60%. Consequently, the Ayurvedic "prescription" for turmeric and its anti-aggregator properties which have long been recognised, receives more backing. The consumption of foods rich in ginger, onion and garlic may help to lower the risk of heart disease and stroke. Ginger extracts were found to reduce digestive issues in rats by up to 97% in laboratory studies. The findings indicated that the components zingiberene, the primary terpenoid and 6-gingerol, the pungent principle, made the traditional use of ginger in stomachic therapies beneficial. Zingiberene is the main terpenoid in ginger while 6-gingerol is the pungent principle in ginger. The primary terpene, zingiberene as well as the bitter component, 6-gingerol are found in this plant. According to current study, the oils from both plants block the fatty acid oxygenases present in platelets, resulting in a reduction in the coagulation of these blood cell components. During a double-blind, randomised crossover trial conducted in 1991, thirty pregnant women with hyperemesis gravidarum took part. In the absence of ginger, a placebo was utilised. Seventy percent of the women reported that they enjoyed their period while using the ginger supplement. Because ginger was shown to significantly improve the relief of the subjective feelings, an objective examination verified the subjective emotions. Several investigations conducted by Japanese experts revealed that ginger extracts can significantly reduce stomach ulcers in rats by up to 97% when a series of tests were performed. They found it after doing study on zingiberene, the most abundant terpenoid (6-gingerol) as well as the pungent component of ginger. The historic usage of ginger in stomachic medicines proved beneficial to patients^[7-10].

Ginkgo: Botanical name is: *Ginkgo biloba* (*G. biloba*); the parts that are consumed: leaves. Recommended dosage is: 0.5 oz leaves/1 pint water based on the desired impact, soak the plant material in boiling water for 5-20 min before usage. Every day, drink 1 to 2 cups of Ginkgo biloba extract, hot or warm, in the evening and first thing in the morning. Ginkgo biloba extract has been shown to be at least as efficient in scavenging free radicals as uric, a powerful, found naturally antioxidant. The plant extract also has the ability to prevent the production of free radicals which uric acid lacks. Many additional aspects of ginkgo study have been pursued. Vascular disorders, brain function, impotency, dopamine production, inflammation and asthma are among the most fascinating and relevant findings. Tebonin is a supplement made from ginkgo leaves. Tebonin has been shown in medical assessment to increase blood flow and vasodilation in down deep medium and small arteries. Capillary and terminal artery blood flow is increased. Tebonin decreased memory loss and dizziness in the aging. Ginkgo biloba is a great geriatric vitamin. Mild memory loss is a medical issue as well as a tragedy. The structure of ginkgolides and bilobalides, for example, is unique in the vegetable world. In a double-blind, placebo-controlled study, another powerful impact of this traditional Chinese herbal medicine was found. Thirty-one people with moderate to severe memory loss were followed for six months while taking a *G. biloba* extract that was standardised. They were all in their fifties. The flavonoid glycoside concentration of the extract is 24%, while the terpene level is 6%. Ginkgo biloba extract "has a favourable impact on mental efficiency in older individuals with moderate to severe organic memory impairment," according to the results. Sixty males with vascular erectile dysfunction were given a daily dose of 60 mg of Ginkgo biloba extract. Half of the patients were able to re-establish penile erections after 6 months. More over half of the patients who were still alive showed some signs of improvement. Another study found that *G. biloba* extract may protect human kidneys and livers against the immunosuppressive medication cyclosporin A which is often used in transplants. This herbal supplement was shown to be just as efficient in guarding against such damage as vitamin E and glutathione, emphasising the importance of nutritional and herbal supplements in modern treatment. Because of the limitations presented by this strong oxidant, the protective benefits of *G. biloba* extract were decreased in the presence of iron. Ginkgo has also been proven to have anti-allergic and anti-asthmatic properties. Among other pathophysiological illnesses, platelet activating factor has been linked to allergic inflammation, anaphylactic shock and asthma. Ginkgolide B is the most powerful platelet activating factor antagonist discovered in this family of ginkgolides, according to one study.

Because of its platelet activating factor antagonistic action, ginkgo seems to have

bronchoconstriction-relieving effects (see below). In an eight-patient randomised, dual, placebo-controlled crossover trial, ginkgo significantly reduced the bronchial allergen challenge when compared to placebo.

Licorice: Botanical name is: *Glycyrrhiza glabra*; The major parts that are used: root. Recommended dosage: 1 teaspoon of the root or underground stem, boiled in 0.5-1.0 quarts of water for approximately 30 min. Close the jar and let the liquid to cool gradually. Drink 1 to 2 cups each day, cool, 1 swallow or 1 spoonful at a time. The presence of glycyrrhizin, a triterpenesaponin that is almost fifty times sweeter than sugar and has a strong cortisone-like action, is largely responsible for the pharmacological properties of licorice roots and rhizomes. Glycyrrhizin has a sweet taste and has a cortisone-like action. Humans who consumed 6-8 ounces (a really significant quantity) of liquorice candies every day for many days were “sickened” as a consequence of the cortisone-like effects of the licorice extract contained in the candy, according to medical literature. Patients can return to normal after receiving proper therapy. In comparison to the very tiny quantity present in supplements, the aforementioned amount of this chemical is extremely significant. The mucilaginous content of licorice rhizomes and roots is high. The resulting combination has a pleasant o dour and flavour and it works well as a demulcent on irritated mucous membranes such as a sore throat. Glycyrrhizin was shown to be just as efficient as codeine at suppressing coughing in one research. Glycyrrhizin was discovered to prevent mice from skin cancer in a 1991 study. The researchers believed that it could also be beneficial in preventing some types of human cancer. Licorice and glycyrrhizin have a wide range of uses which is not unexpected. On a dry weight basis, this chemical accounts for only 7-10% of the total root weight. When the primary component of licorice is acid hydrolyzed, glycyrrhetic acid is produced. Anti-inflammatory effects of this chemical are widely utilised in Europe, particularly in Addison's disease and peptic ulcer. Glycyrrhetic acid, according to some European experts, may be preferable to cortisone since it is safer, especially when long-term therapy is necessary. Glycyrrhetic acid exerts its action by decreasing the conversion of cortisol to cortisone, its physiologically inactive derivative, according to a research published in 1990. The scientists determined that adding 2% glycyrrhetic acid to hydrocortisone, a “poor antiinflammatory drug”, substantially increases its potency. Patients should take hydrocortisone with glycyrrhetic acid to reduce the harmful effects of corticosteroids on their bodies, according to the researchers. In addition, antiviral effects of glycyrrhizin have been demonstrated. Glycyrrhizin suppressed Epstein-Barr virus, cytomegalovirus and hepatitis B virus,

according to a 1979 research. Glycyrrhizin has been used to treat chronic hepatitis B in Japan for a long time. As a result, it's been suggested that glycyrrhizin might be useful in the treatment of HIV. Ingestion of excessive quantities of licorice has been linked to negative side effects. In excessive doses, glycyrrhizin can cause hypokalemia and hypertension. People with heart issues or high blood pressure should avoid ingesting excessive amounts of licorice or its components for these reasons.

Schizandra: Botanical name: *Schizandra chinensis*; the parts that are used for consumption: Berry. Recommended dosage: 1-2 g pill or capsule each day some of the biological actions of this interesting plant include antibacterial (equivocal results), sympathomimetic (stimulant), resistance stimulation, liver protection, anti-toxic, antiallergenic, depressed, glycogenesis stimulant and antioxidant. As a “tonic”, it protected mice against alcohol, pentobarbital and the deadly ether. The authors suggested that schizandra might be a beneficial therapeutic treatment for reversing central nervous system depression as a consequence of these findings. This antidepressant action was predicated on the idea that depression might be caused in part by adrenergic fatigue as a result of extreme psychogenic stress. Monoamine oxidase inhibitors and other drugs that enhance noradrenergic neurotransmission in the brain, including imipramine have been shown to be helpful in treating human depression. This plant is also touted for its ability to stimulate the neurological system without being as stimulating as amphetamine or caffeine. Some supporters argue that “the greater the degree of fatigue, the greater the invigorating effect.” A fascinating examination of racing horse performance appears to back up the folklore beliefs. Polo horses fed the berry extract of this species showed a reduced heart rate rise during exercise, a faster rehabilitation of respiratory function, a decreased level of serum lactate and performance improvement. A lignan element of the schizandra fruit has the capacity to inhibit the arachidonic cascade in macrophages, according to a 1990 research. The production of leukotrienes is enhanced when the arachidonic cascade is active which might also play a role in developing of inflammation-related illnesses. Schizandra protects the liver while simultaneously boosting the immune system by inhibiting the arachidonic acid cascade, two essential properties of a good adaptogen. Mice were employed in a non-Western study to assess the “tonifying and energising yang” characteristics of schizandra and some other plants. The researchers examined the animal's body mass, glandular weight, leukocyte count as well as other “yang” characteristics. They observed a connection between herb consumption (in the form of hot water extracts) and improved immune function. They also noted a significant anti-fatigue property as indicated by decreased

parasympathetic nervous system excitability. There was no evidence of toxicity. The antioxidant activity of dibenzo-cyclooctenelignans derived from *Schizandra* species was discovered and reported in 1992. This growing herb from the Far East looks to be a serious contender for the title of “new” anti-fatigue agent since it appears to aid in the speeding up of restorative processes within the human body. Traditional Chinese Medicine (TCM) continues to make significant contributions to the annals of world medicine by nominating new nominees. In contrast to the medical establishment, “conventional” or “old” medicine is truly the healthcare of the people as we are discovering in the West. Despite the fact that schizandra is a relatively safe plant with a long history of usage, a standardised extract source advises against taking it if you have high intracranial pressure or chronic hypertension or if you have “high acidity”.

Turmeric: Botanically called as: *Curcuma longa*; the Parts that are used are rhizome. One to two g per day in meals or capsules/tablets are recommended. Nausea, liver issues, asthma, diabetes ulcers, rheumatic and sinus are all treated with turmeric in India. One researchers focused at the anti-carcinogenic and anti-mutagenic properties of turmeric extract. This ancient spice was discovered to decrease the incidence of tumours in mice, as well as the mutagenicity of benzo(a) pyrene and two additional powerful mutagens, 4-nitro-ophenylenediamine and dimethylbenzanthracene, in laboratory (non-human) experiments. Finally, cancer prevention is receiving the attention it deserves. In many biochemical and epidemiological studies, diet has been demonstrated to have a role in cancer prevention. Turmeric’s main active ingredient (curcumin) has been shown to be a powerful antimutagenic agent in laboratory tests. The concept of free-radical inactivation which is becoming generally recognized, is discussed for individuals interested as far as how curcumin might help to cure cancer. The carcinogens employed in the research, benzo(a) pyrene and dimethylbenzanthracene, are metabolically converted into proximal mutagenic/carcinogenic epoxides that bind to macromolecules and induce cancer. According to one study, curcumin is a strong antioxidant which may absorb epoxides and inhibit macromolecules from adhering each other. To put it another way, the antioxidant properties of this spice are similar to those of dietary antioxidants like vitamins C and E which inhibit free radical processes. Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) are a type of plant. Curcumin reduces cyclooxygenase and lipoxygenase enzymes. It acts in three different ways: as an antioxidants, as a lipoxygenase blocker and as a cyclooxygenase inhibitor. By blocking the metabolic processes that produce inflammation, it may be decreased. Therefore, contemporary science confirms what traditional healers have been stating for hundreds of years,

if not thousands of years. Freshly rhizome extract has indeed been observed to reduce inflammation in acute bruising, cuts and bug bites, whereas dried powdered root was shown to destroy parasites, cure head cold symptoms and relieve rheumatic pains. Surprisingly, this spice has been employed in the past to adulterate ginger, according to historical records. Many of turmeric’s folkloric effects, such as healing process, induced gastric protection, anti-spasmodic activity, reduce in intestinal gas formation, preventative measures of liver cells, enhancing bile production, lowering platelet activation (i.e., blood clumping), reducing serum cholesterol (at very high doses), potent antimicrobial activity were discovered in a plethora of studies. While the majority of the aforementioned effects were proven in animals using intravenous extracts, they are consistent with folkloric claims in people and should not be disregarded as “experimental” or “trivial”. Turmeric’s anti-arthritis properties have been shown in human clinical studies. In a randomised, double-blind, placebo-controlled trial, a herbal combination containing turmeric ashwagandha and boswellin was tested. Twelve osteoarthritis patients were randomly allocated to receive either as the herbal blend or a placebo for three months after a one-month assessment phase. Every two weeks, the patients were assessed. The therapy was reversed after a 15-day washout period, with placebo patients receiving the medicine and drug patients receiving the placebo. The outcomes were examined for a third time during a three-month period. The degree of pain and disability score in individuals treated with the herbal mixture decreased significantly.

Quercetin: Among higher plants, Quercetin is the most prevalent flavonoid. It’s most often found as an aglycones, including such rutin, quercetin, myricetin, hyperin and quercimeritrin but it’s also found in the Poaceae, Passiflorae, Rhamnaceae and Solanaceae families, mostly on surface of the leaf, in fruits and in buds isolates^[11]. In both enzymatic and nonenzymic systems, quercetin is a powerful antioxidant that lowers superoxide anions. Its antiulcer and gastroprotective properties, particularly against ethanol damage were shown in a recent animal research. The cytoprotective effect was influenced by a number of interconnected mechanisms including prostaglandin stimulation and inhibition as well as quercetin’s antioxidant capabilities. The most effective dosage for avoiding necrosis in experimental organisms was 200 mg kg⁻¹ (a very high dose) given 120 min earlier ethanol was administered^[11].

Plants that are well-known for their antioxidant properties: Numerous plants have been examined, in addition to several have been discovered to contain antioxidant properties.

CONCLUSION

Nature is the greatest combinatorial chemist, as shown by the previous argument and provides probable answers to all human diseases. The ability of medicinal plants to produce antioxidants is critical. As a consequence of the harmful impacts of modern medicine, people's attention has already been attracted to herbal treatments. It is critical to show the use of the safer indigenous system in the treatment of a range of diseases in order to gain public acceptance and comprehension. We must integrate herbal medicine systems into our health-care systems because health-care systems are getting more costly. Let us hope that natural goods will be able to compete with contemporary medicines in the future, providing additional advantages such as increased safety and cheaper prices.

REFERENCES

01. Alan, D., 1999. The Oxford Companion to Food. Oxford University Press, Gabon Nut, London.
02. Dragland, S., H. Senoo, K. Wake, K. Holte and R. Blomhoff, 2003. Several culinary and medicinal herbs are important sources of dietary antioxidants. *J. Nutr.*, 133: 1286-1290.
03. Velioglu, Y.S., G. Mazza, L. Gao and B.D. Oomah, 1998. Antioxidant activity and total phenolics in selected fruits, vegetables and grain products. *J. Agric. Food Chem.*, 46: 4113-4117.
04. Niwano, Y., K. Saito, F. Yoshizaki, M. Kohno and T. Ozawa, 2010. Extensive screening for herbal extracts with potent antioxidant properties. *J. Clin. Biochem. Nutr.*, 48: 78-84.
05. Sawant, O., V.J. Kadam and R. Ghosh, 2009. *In vitro* free radical scavenging and antioxidant activity of *Adiantum lunulatum*. *J. Herbal Med. Toxicol.*, 3: 39-44.
06. Saito, K., M. Kohno, F. Yoshizaki and Y. Niwano, 2008. Extensive screening for edible herbal extracts with potent scavenging activity against superoxide anions. *Plant Foods Hum. Nutr.*, 63: 65-70.
07. Balch, P.A., 2006. Prescription for Nutritional Healing. 4th Edn., Penguin Books, New York, USA...
08. Adhikari, S., K.I. Priyadarsini and T. Mukherjee, 2007. Physico-chemical studies on the evaluation of the antioxidant activity of herbal extracts and active principles of some Indian medicinal plants. *J. Clin. Biochem. Nutr.*, 40: 174-183.
09. Hikino, H. and Y. Kiso, 1988. Natural Products for Liver Diseases. In: Economics and Medicinal Plant Research, Wagner, H., H. Hikino and N.R. Farnsworth (Eds.). Vol. 2. Academic Press, London, pp: 39-72.
10. Fisher-Rasmussen, W., S.K. Kjaer, C. Dahl and U. Asping, 1991. Ginger treatment of hyperemesis gravidarum. *Eur. J. Obst. Gynecol. Reprod. Biol.*, 38: 19-24.
11. Lastra, D.L.A., M.J. Martin and V. Motilva, 1994. Antiulcer and gastroprotective effects of quercetin: A gross and histologic study. *Pharmacology*, 48: 56-62.