



A Review on Management of Oxidative Stress with Various Anti-Oxidative Herbs

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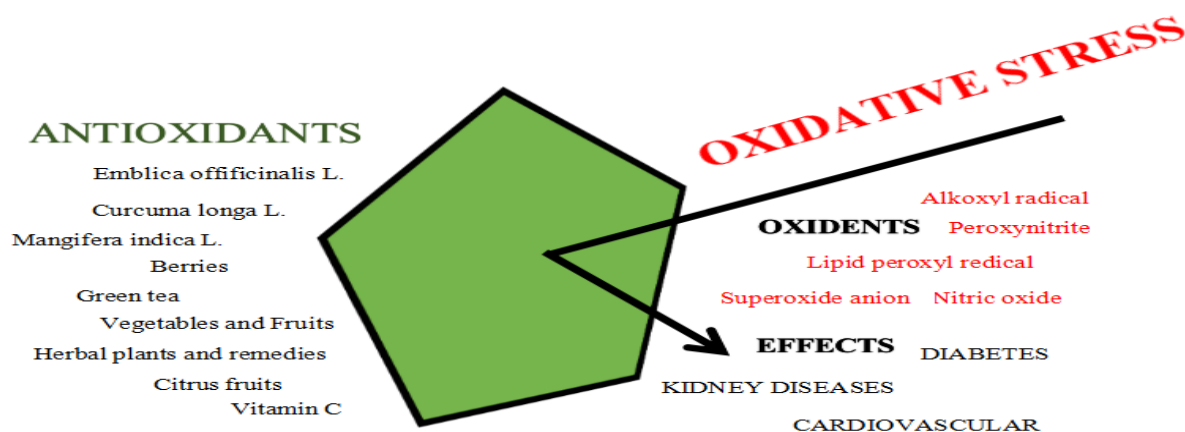
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ABSTRACT

The major focus of this review paper is based on antioxidants' capacity (of various types and supplies, utilizing diverse mechanisms of action) to mitigate oxidative stress and the role of reacting oxygen species in generating oxidative injury to the lipids in cell membranes. According to the definition of oxidative stress, cells' redox equilibrium is out of balance and there is excessive production of reactive oxygen radicals, which antioxidants cannot stop.

Key words: Anti oxidant capacity, Anti oxidants, Oxidative stress, Oxygen, Cell membranes

GRAPHICAL ABSTRACT:



INTRODUCTION

Oxidative stress is brought on by reactive oxygen intermediates that can damage enzymes, nucleic acids, and cellular membranes, such as superoxide radicals, H₂O₂, and hydroxyl radicals. The cumulative damage caused by reactive oxygen species is becoming implicated as the root cause of several ailments by increasing amounts of evidence(1). According to one definition of oxidative stress, there is an imbalance between the number of reactive oxygen

molecules produced and the body's capacity to fend the number of reactive oxygen molecules produced and the body's capacity to fend those off via antioxidative defense systems (2). When endogenous systems are less able to defend against an oxidative attack directed at target bio-molecules, this condition is referred to as oxidative stress. This condition can be caused by either an increase in the formation of reactive oxygen molecules or a decline in the antioxidants' ability to protect cells. Its severity is associated with a variety of illnesses, such as cancer, cardiovascular disease, and ageing (3,4).

For damaging oxidative processes, reactive oxygen species which are subjected to O_2 are often to blame. It was also noted that nitric oxide radicals may form reacting nitro species, which are N-containing radical species. Consequently, reactive oxygen and nitro atoms are not just considered to be species capable of destroying bio-molecules. Other assertions assert that, in addition to chemical defense or detoxification, enzyme systems also generate active compounds in cell signaling and bio-synthetic activities (3). Current research also suggests a close connection between the damage caused with HClO and the extremely reactive nitrogen mediator nitric oxides, and nitrosothiols. Enzymes that detoxify activated oxygen molecules and heal the damage they cause are produced by cells on a constitutive basis to protect them from oxidative stress.

Table 1: List of Herbal Plants, Remedies, Vegetables and fruits with anti oxidant activity

Sr. no	Scientific Name	Common Name
1.	<i>Emblica officinalis</i> L.	Indian Gooseberry
2.	<i>Curcuma longa</i> L.	Turmeric/Curcumin
3.	<i>Mangifera indica</i> L.	Mango
4.	<i>Momordica charantia</i> L.	Bitter-melon
5.	<i>Santalum album</i> L.	Sandalwood
6.	<i>Withania somnifera</i> (L.) Dunal	Ashwagandha
7.	<i>Apium graveolens</i> L.	Celery
8.	<i>Camellia sinensis</i>	Green Tea
9.	<i>Persea americana</i>	Avocado
10.	<i>Daucus carota</i>	Carrot
11.	<i>Allium cepa</i>	Onion
12.	<i>Brassica oleracea</i> var. <i>italica</i>	Broccoli
13.	<i>Ipomoea batatas</i>	Sweet Potato
14.	<i>Allium sativum</i>	Garlic

15.	Vaccinium sect. Cyanococcus	Blueberries
16.	Olea europaea	Olives
17.	Beta vulgaris subsp. vulgaris Conditiva Group	Beetroot
18.	Fragaria × ananassa	Strawberries
19.	Rubus idaeus	Raspberries
20.	Brassica oleracea var. sabellica	Kale

1. Emblica officinalis L.

Family: Euphorbiaceae

Indian Gooseberry (*Emblica officinalis* L.) is a popular name for this plant. For thousands of years, traditional Indian medicine has employed the fruits of *P. emblica* to cure a variety of illnesses. For a long time, the fruits' high ascorbic acid content—1 gram of vit C per Hundred ml of pure juice—was thought to provide medicinal benefits (5). Because specific tannins were present, even in dried fruit, it did not oxidize, keeping the antiscorbutic potential untouched. Antioxidants including gallic acid, ascorbic acid, and phenolic compounds, which are abundant in amla, support the body's immunological and digestive systems. Moreover, certain investigations (6) and (7) that exaggerated the strong antiscorbutic capability were reported.

Ascorbic acids and *P. emblica* were compared in all investigations that were published afterward; it was shown that *P. emblica* was more efficient than ascorbic acid both in vitro and in vivo. The high concentration of ascorbic acid was the explanation for all of these findings. In 1996, Banaras Hindu University's professor Shibhnath Ghosal (8) found that while *Emblica* fruits lack ascorbic acid in either its free or conjugated form, they do contain two novel hydroxyl tannin having lower molecular mass, referred to as emblicanin A (2,3-di-O-galloyl-4,6-(S)-hexahydroxydiphenoyl-2-keto-glucono-d -lactone) and emblicanin B (2,3,4,6-bis-(S)-hexahydroxydiphenoyl-2-keto-glucono-d -lactone) and other tannins as pedunculagin (2,3,4,6-bis-(S)-hexahydroxydiphenoyl-D-glucose) and punigluconino (2,3-di-O-galloyl-4,6-(S)-hexahydroxydiphenoylgluconic acid), which have already been found in other species, particularly *Punica granatum*. These two novel tannins have potent antioxidant properties. It has been discovered that the 2 emblicanins A and B protect erythrocytes against the superoxide radicals that asbestos produces when exposed to oxidative stress. Together, they have a higher protective effect on erythrocytes than vit C. Emblicanin A oxidizes into emblicanin B when it comes into contact with asbestos.

2. Curcuma longa L.

Family: Zingiberaceae

Curcumin is the common name for the plant *Curcuma longa* L. In studies using carrageenin, caoline, and formalin to generate edoema and arthritis, it was shown that curcumin as well as

its sodium salt had potent anti-inflammatory, corticosteroid-like, and antioxidant effects. Moreover, studies have indicated that natural available analogues of curcumin, such as bis-(4-hydroxycinnamoyl)-methane and feruloyl-(4-hydroxycinnamoyl)-methane, have comparable benefits. Many spasmogens are antagonistic by sodium curcumin. The stomach mucosa is protected against irritants by turmeric powder. Flatulence is avoided with turmeric (9). The liver is protected by curcumin and the related substances p-coumaroyl methane and di-p-coumaroyl methane from CCl₄ and D-galactosamine. Production of bile is increased. In vitro and in vivo, curcumin and its derivatives prevent platelet aggregation (9). Turmeric extract has demonstrated antimutagenic properties (10). The turmeric aqueous extract has been used to isolate TAP (turmeric antioxidant protein). The preservation of the enzyme's SH group is likely how the antioxidant action is carried out. Reagents that decrease thiol groups have produced results that are similar (11).

3. *Mangifera indica* L.

Family: Anacardiaceae

Mango is scientifically referred to as *Mangifera indica* L. The mango (*Mangifera indica* L.) fruit is an excellent resource of dietary antioxidants such as ascorbic acid, carotenoid, and mainly phenols compounds (12), which have shown a variety of health-promoting qualities, mostly because of their exceptional antioxidant capacity (13). Among other health advantages, bioactive substances reduce the risk of various malignancies, atherosclerosis, and cardiovascular disorders (14,15). Mango eating on a regular basis may therefore offer considerable amounts of bioactive substances with antioxidant potential.

Mangiferin is C-glucosyl xanthone and contains diuretic and cardiogenic effects. Strong antiviral action is demonstrated by gallic acid and quercetin. Thymocyte and splenic lymphocyte proliferative responses to mangiferin peak at 5.0 mg/ml and 20.0 mg/ml, respectively, after 48 hours (16). Mango fruits have a high concentration of polyphenols, which include flavonoids, xanthenes, & phenol acids. Mangiferin has exceptional anti-inflammatory properties. Mangiferin are an anti-oxidant capable of the following at various stages of the oxidation sequence:

- Reduce the O₂ level and produce mangiferin phenoxy radicals to stop lipoperoxidation.
- Metal ions that bind, such as Fe³⁺ and Fe²⁺, prevent the formation of h⁺ ions and/or oxo-ferryl groups.
- Control the start of the polymer chain by reacting with ROS to create a weakly reactive oxoradical.
- Function as a scavenger to lipids peroxy & alkoxy radical & stop H from intracellular lipids from being abstracted.
- Keep the ratio of cellular oxidants to antioxidants in equilibrium (17).

4. *Momordica charantia* L.

Family: Cucurbitaceae

Momordica charantia L., sometimes referred to as bitter melon, is a plant. The secondary metabolites known as phenolic compounds are crucial for the development & fertility of plants. They are created as a means of protecting harmed plants from diseases and are referred to as hydrophilic antioxidants. They may have anti-inflammatory, antioxidant, anti-tumor, anti-mutagen, and anti-carcinogenic activities (18).

These effects are mostly caused by the bitter melon's triterpene, proteid, steroids, alkaloid, chemical, lipid, & phenol components (19). It has been demonstrated that the proteins in bitter melon, such as protein MAP-30, alpha-momorcharin, and beta-momorcharin, can combat HIV (20). It has been demonstrated that the steroid charantin, which is mostly found in aerial portions, has anti-diabetic properties (21). According to reports, the phenolic components from a bitter melon that were isolated by solvent extraction have antioxidant potential (22).

5. Santalum album L.

Family: Santalaceae

Sandalwood is the common name for Santalum album L. By boosting the glutathione-S-transferase (GST) activities and the acid-soluble SH level in the liver, sandalwood oil exhibits indirect antioxidant action (23).

The Food and Drug Administration (FDA, USA) has authorised the use of sandalwood essential oil (SEO) in combination with other tastes for human consumption (24). Due to its antioxidant (25), neuroprotective (26), anti-inflammatory (27), & antibacterial (28) qualities, SEO also possesses a number of additional pharmacological effects.

6. Withania somnifera (L.) Dunal

Family: Solanaceae

Known as Indian Ginseng/Winter Cherry in English, Amukkara in Sinhala and Ashwagandha in Sanskrit, Withania somnifera (L.) Dunal. is a therapeutically significant medicinal plant that has been utilized for over 3000 years in Ayurveda and traditional systems of medicine (29). Recent research has demonstrated that oxidative stress is a significant contributor to the genesis of many illnesses, and antioxidants may be helpful in their management (30,31,32).

In the frontal cortex and striatum of the rat brain, sitoindisides VII–X and withaferin–A, the active components of ashwagandha, have been demonstrated to have strong antistress and antioxidant properties (33). Even though the antioxidant components in ashwagandha are thought to be responsible for many of these therapeutic benefits, there is no comprehensive report on the results of the antioxidant profile assays.

Conclusion:

Oxidative stress, which is also more accurately described as a disruption of redox signaling, is caused by excessive production of reactive oxygen species as well as consists of an unbalance of oxidant to reducing species. Key bio-molecules are altered and their functions

are modulated by reactive oxygenated or nitrogenated species such as hydroxyl, alkoxyl, nitric oxide, & peroxyxynitrite. It has been hypothesized that organisms can maintain a consistent degree of oxidative stress regardless of the use of antioxidant supplements. According to a claim, antioxidant supplementation is helpful if the starting level of oxidative stress is higher than average or higher than the person's stable level. Antioxidants can have positive interactions with one another, for as when synthetic phenolic antioxidants work synergistically or when reduced coenzyme Q or vitamin C regenerates tocopherol from its oxidized state, the tocopheroxyl radical. When transition metallic atoms or lipids hydroperoxides are present, for example, antioxidants may display pro-oxidative effects. This means that they participate in redox systems that generate reactive oxygenated species, especially hydroxyl radicals.

We detail the major functions of antioxidants in biological functions and disorders, as well as how the natural antioxidant components of herbs affect their health-promoting characteristics, in this review paper.

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