

A REVIEW ON ANTIOXIDANTS AS NEXT GENERATION THERAPEUTIC APPROACH

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Abstract:

The rising prevalence of many diseases is a growing concern in worldwide. Antioxidants are substances that prevent oxidation of other compounds or neutralize free radicals. Spices and herbs are rich sources of antioxidants. They have been used in many areas like food and beverages to improve its flavor, aroma and color. Due to their excellent antioxidant activity, spices and herbs have also been used to treat some diseases. This review focuses on the association between antioxidants and therapeutic approaches that may be the key to their use as potential remedy to treat various diseases. The antioxidant properties of some species and its importance in medicine to treat several diseases and its chemical compositions were discussed and summarized. The antioxidants play a major role in the area of medicine in next generation. This might be a novel approach in the field of medicine to treat various diseases and disorders.

Key words:

Antioxidants, therapeutic agent, herbs, chemical constitutions

INTRODUCTION

An antioxidant is a chemical that prevents the oxidation of other chemicals. They protect the key cell components by neutralizing the damaging effects of free radicals, which are natural by-products of cell metabolism [1, 2]. Antioxidants can protect lipids and oils in food against oxidative degradation. When added to food, antioxidants control rancidity development, retard the formation of toxic oxidation products, maintain nutritional quality, and extend the shelf-life of products. Because of safety concerns, synthetic antioxidants are limited to be used as food preservatives. Natural antioxidants obtained from edible materials such as spices and herbs, have been of increasing interest.

Natural antioxidants contained in spices help to reduce oxidative stress. Oxidative stress, which is caused by high concentration of free radicals in cells and tissues, can be induced by various negative factors, such as gamma, UV, and X-ray radiation, psycho-emotional stress, polluted food, adverse environmental conditions, intensive physical exertion, smoking,

alcoholism, and drug addiction. Chronic oxidative stress has been reported to lead to a variety of diseases, including cancer, heart related diseases, and the acceleration of aging. Several secondary products of lipid oxidation, such as malondialdehyde and 4-hydroxynonenal, can react with biological components such as proteins, amino acids, and DNA. Malondialdehyde has been shown to be formed both enzymatically and non-enzymatically, and has been implicated in health problems such as mutagenesis and carcinogenesis. Spices and culinary herbs are rich in antioxidants. Therefore, spices could potentially be used as ameliorative or preventive agents for some health issues [3-8].

In a normal cell, there is appropriate oxidant: antioxidant balance. However, this balance can be shifted, when production species is increased or when levels of antioxidants are diminished. This stage is called oxidative stress. Oxidative stress results in the damage of biopolymers including nucleic acids, proteins, polyunsaturated fatty acids and carbohydrates. Lipid peroxidation is oxidative deterioration of polyunsaturated lipids and it involves ROS and transition metal ions. It is a molecular mechanism of cell injury leading yield a wide range of cytotoxic products, most of which are aldehydes, like malondialdehyde (MDA), 4-hydroxynonenal (HNE), Oxidative stress causes serious cell damage leading to a variety of human diseases [9] like Alzheimer's disease, Parkinson's disease, atherosclerosis, cancer, arthritis, immunological incompetence and neurodegenerative disorders, etc. Nutritional antioxidant deficiency also leads to oxidative stress, which signifies the identification of natural anti-oxidative agents present in die consumed by human population [10, 11].

THE ANTIOXIDANT ACTIVITY OF PLANT SPECIES IS RELATED TO THEIR CHEMICAL COMPOSITION

The antioxidant activity of spices is related to their chemical composition; primarily to the presence of polyphenolic and other biologically active compounds. Table 1 lists primary antioxidants and the biologically active compounds found in spices and culinary herbs that include flavonoids, phenolic acids, lignans, essential oils, and alkaloids, as summarized from several publications [23–25]. These compounds were largely determined by chromatographic methods.

Table: 1 Phytochemical Constitutions of various herbs

S.NO	HERBS	PHYTOCHEMICAL CONSTITUTIONS
1.	Cloves	Eugenol, isoeugenol, acetyleugenol, sesquiterpene, pinene, vanillin, gallic acid, flavonoids, phenolic acids
2.	Cinnamon	Eugenol, limonene, terpineol, catechins, proanthocyanidins, tannins, linalool, safrole, pinene, methyleugenol, benzaldehyde
3.	Cardamon	Limonene, 1,8-cineole, terpinolene, myrcene, caffeic acid, quercetin,

		kaempferol, luteolin, pelargonidin
4.	Coriander	Linalool, borneol, geraniol, terpineol, cumene, pinene, terpinene, quercetin, kaempferol, caffeic, ferulic, n-coumaric and vanillic acids, rutin, tocopherols, pyrogallol
5.	Turmeric	C8. urcumins, essential oils, eu9. genol, carotene, ascorbic acid, caffeic, p-coumaric, protocatechuic, syringic, vanillic acid
6.	Ginger	Gingerol, turmeric, paradol, geraniol, geranial, borneol, linalool, camphene, zingerol, zingiberon
7.	Anise	Camphene, pinene, linalool, trans-, cis-anetholes, eugenol, acetanisole, rutin, luteolin-7-glucoside, apigenin-7-glucoside, isoorientin
8.	Caraway	Monoterpenes, sesquiterpene, aromatic aldehydes, terpene esters, terpenol, terpenal, terpenon, limonene, safranal, kaempferol, quercetin, tannins, caffeic, ferulic, p-coumaric, and chlorogenic acids
9.	Fenugreek	Sesquiterpenes, aromatic aldehydes, terpenes
10	Black pepper	Piperine, pinene, camphene, limonene, terpenes, piperidine, isoquercetin, sarmentine
11	Oregano	Apigenin, quercetin, luteolin, myricetin, diosmetin, eriodictyol, carvacrol, thymol, rosmarinic, caffeic, p-coumaric, protocatechuic acid
12	Basil	Apigenin, catechins, quercetin, rutin, kaempferol, anthocyanins, eugenol, limonene, terpinene, carvacrol, geraniol, menthol, safrole, tannins, ursolic, p-coumaric, rosmarinic acids
13.	Bay leaf	1,8-cineole, cinnamtannin
14.	Garlic	Allicin, diallyl sulfide, diallyl disulfide, diallyl trisulfide, allyl isothiocyanate, S-allyl cysteine

ANTIOXIDATIVE PLANT INGREDIENTS AND EXTRACTS AS PROMISING PREVENTIVE / THERAPEUTIC STRATEGIES FOR CADMIUM TOXICITY

A subject of special interest is also the possibility of using natural plant ingredients and plant extracts in protection from effects of exposure to xenobiotics, including especially environmental pollutants like Cd. The most promising plant origin compounds effective in this protection involve compounds present in numerous plant products such as polyphenols, diallyl compounds present in garlic and onion, carotenoids, coenzyme Q10, and melatonin. Moreover, attention should also be paid to some plant extracts, including not only the well known from their favourable action in the organism and widely used extracts (e.g. black and green tea, *A. melanocarpa*), but also less popular and even poorly recognized extracts [12-47] (Table 2).

Table: 2 Phytochemical constituents and its actions of various plants

PLANT NAME	ACTIONS	ACTIVE CONSTITUENTS
<i>Arctium lappa</i>	Hepatoprotective	Flavonoids, phenolic acids, polyacetylenes, essential oil, lignans
<i>Brassica</i> species	Hematoprotective	Glucosinolates, flavonoids, phenolic acids, brassinossteroids, vitamin C
<i>Chlorella vulgaris</i>	Hepatoprotective	Polyphenolic compounds, protein, lipids
<i>Cinnamomum zeylanicum</i>	Hepatoprotective	Essential oil, proanthocyanidins
<i>Corchorus olitorius</i>	Hepatoprotective	Flavonoids, phenolic acids
<i>Cynara scolymus</i>	Testes protection	Caffeic acid, chlorogenic acid, cynarin, cynaroside
<i>Emblica officinalis</i>	Cytoprotective	Tannins, flavonoids, alkaloids,
<i>Glyphaea brevis</i>	Hepatoprotective	Polyphenolic compounds, triterpenes, phytosterols, polyols
<i>Hibiscus sabdariffa</i>	Hepatoprotective	Antocyanins, flavonoids
<i>Irvingia gabonensis</i>	Antioxidative, Hepatoprotective	Alkaloids, flavonoids, carotene, vitamins C and E
<i>Jussiaea nervosa</i>	Hepatoprotective, Hemoprotective, Nephropro- tective	Flavonoids, alkaloids, saponins, tannins
<i>Juglans regia</i>	Hepatoprotective	Tannins, flavonoids, essential oil,

		terpenoids
<i>Momordica charantia</i>	Nephroprotective	Flavonoids, alkaloids, terpenoids, proteins, phytosterols
<i>Murraya koenigii</i>	Myocardioprotective Hepatoprotective	Flavonoids
<i>Nigella sativa</i>	Cytoprotective, Immunoprotective	Phytosterols, essential oil, saponins, alkaloids
<i>Olea europea (oil)</i>	Testes protection	Oleic acid, linoleic acid
<i>Origanum majorana</i>	Hepatoprotective, Nephroprotective	Flavonoids, phenolic acids, essential oil, triterpenes
<i>Physalis peruviana</i>	Hepatoprotective Nephroprotective Neuroprotective testes protection	Quercetin, kaempferol, myricetin
<i>Piper betle</i>	Hepatoprotective	Polyphenols, alkaloids, essential oil, phytosterols, saponins, tannins
<i>Psidium guajava</i>	Hepatoprotective	Flavonoids: morin, tannins, essential oil, triterpenes
<i>Rosmarinus officinalis</i>	Hepatoprotective	Essential oil, rosmarinic acid, phenolic acids, flavonoids
<i>Satureja hortensis</i>	Pancreate protection	Flavonoids, phenolic acids, essential oil
<i>Silybum marianum</i>	Hepatoprotective	Flavonolignans complex: silymarin
<i>Terminalia chebula</i>	Nephroprotective	Tannins, saponins
<i>Tribulus terrestris</i>	Nephroprotective, hepatoprotective	Flavonoids, saponins, alkaloids
<i>Trigonella foenum-graecum</i>	Hepatoprotective	Favonoids, phenolic acids, saponins
<i>Thunbergia laurifolia</i>	Nephroprotective, hepatoprotective	Flavonoids, phenolic acids
<i>Thymus vulgaris</i>	Hepatoprotective	Essential oil, triterpenes, flavonoids
<i>Zingiber officinale</i>	Hepatoprotective, nephroprotective	Essential oil, diterpenes

EFFECT OF PLANT SPECIES ON HUMAN HEALTH AND OTHER APPLICATIONS

Spices have been reported to have various beneficial effects on human health which include anti-sclerotic, antithrombotic, anti-carcinogenic, anti-inflammatory, antiarrhythmic, anti-rheumatic, gastroprotective, and lipid-lowering action. In addition, spices have radioprotective (protects against radiation), anti-allergic, and antimalarial effects. Spices inhibit the oxidation of low-density lipoprotein and protein glycation [48-52].

EFFECT OF PLANT SPECIES ON ANTISEPTICS

Many spices are highly potent antiseptics because they have an antibacterial, antimicrobial, and even antiviral effect. A synergistic effect on oral bacteria was observed when cloves were used along with antibiotics [53-57]. Spices and herbs have been used as functional food [58-62] and various therapeutic effects of spices from different sources also been classified.

EFFECT OF PLANT SPECIES ON CANCER

The therapeutic effects of certain spices are so significant that they have often been included in non-clinical, clinical, and therapeutic studies. A non-clinical trial of rosemary showed that rosemary could act as a cancer prevention agent. Some clinical and therapeutic trials for evaluation of spices against several diseases have been conducted. Studies show that curcumin possesses anti-inflammatory effects and therapeutic effect in gastrointestinal diseases. It is an inhibitor of low density lipoprotein oxidation and also showed effects against neurodegenerative diseases. Ginger and garlic have extensively therapeutic effects [63, 64, 65-70], especially for cardiovascular diseases. These will be reviewed in following section. Cloves, Nigella, black pepper, garlic, and ginger have been used against cancer [71-75]. Aged aqueous-alcoholic extract of garlic was also reported to be potentially effective against certain cancers [76]. Table 3 summarizes anticancer actions of some spices. The following compounds contained in spices have anti-carcinogenic properties: curcumin, apigenin, luteolin, quercetin, thymoquinone, and isothiocyanate.

Table 3. Effect of spices on cancer

SPICES	CANCER TYPE
Turmeric	Rectal cancer, oral cancer, leukemia, carcinoma of the head and neck
Saffron	Skin carcinoma, rectal cancer, hepatic carcinoma
Garlic	Prostate cancer, colon cancer

Onion	Gastric carcinoma
Turmeric	Leukemia
Mustard	Rectal carcinoma, bladder cancer
Bay leaf	Inhibits melanoma cell growth
Mustard (seeds)	Rectal carcinoma, bladder cancer

EFFECT OF PLANT SPECIES ON CARDIOVASCULAR DISEASES

Some spices play a critical role in the management of heart disease because these spices have been shown to inhibit enzymes involved in lipid synthesis, decrease platelet aggregation, prevent lipid peroxidation, reduce LDL (low-density lipoprotein) levels and increase coronary blood flow.

EFFECT OF PLANT SPECIES ON FOOD PRESERVATION

Spices have been used to preserve food to inhibit or delay lipid oxidation and rancidity in foods. Since ancient times it has been known that spices help preserve many foods. Now the application of spices have become even more broad: extension of cheese shelf-life by adding cinnamon; preservation of vitamin E in sunflower oil by adding different spices; inhibition of omega-3 fatty acid oxidation in vegetable oils by oregano and rosemary as well as sterol oxidation in extra virgin olive oil; extension of meat shelf-life by various spices [77-80]. Due to high antioxidant activity, spices suppress harmful effects of carcinogenic pollutants that may be present in foods and beverages, especially aflatoxins, heterocyclic amines, acrylamide, 1,2-Dimethylhydrazine and cadmium [80-82]. Spices can also neutralize the harmful effects of hazardous solvents and motor exhaust emissions from road transport in urban areas. Therefore, it is important and reasonable to encourage people to consume spices regularly in order to protect them from harmful environmental impacts, especially in large, polluted cities.

CONCLUSION

Based on reviewed literature, the highly potential antioxidants rich herbs taken from the organic source can be used to treat or protect us from various diseases. This review also presents high evidence that the antioxidants retrieved using the plant species can reduce or eliminate the harmful effects on humans against many diseases. The overall review about the antioxidants and its effect on various control remedies against the disease proves that it should certainly be incorporated as novel medicine in next generation.

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