HERBAL REMEDIES AS ANTIOXIDANTS: AN OVERVIEW

Charde M.*[1], Shukla A.[3], Bukhariya V. [3], Mehta J. [3] Chakole R.[2]

[1]*Government College of Pharmacy, Amravati - 444604*
[2]*Department of Pharmacy, Government Polytechnic, Amravati - 444604*
[3]*NRI Institute of Pharmaceutical Science, Bhopal - 462010*

Corresponding author*: kdc_ritu@rediffmail.com

Abstracts

The primary cause of degenerative disease is not due to damaging free radicals, but rather it is due to the requirement of highly ordered cell biochemistry becoming disordered due to insufficient cellular energy to maintain the normal state of order. There is a complex defense system in the body, in which vitamins, minerals, amino acids and certain enzymes play a central role called the antioxidant system. Antioxidants are weapons for combating free radicals and mop up damaging chemicals in the body and guard against many chronic diseases. Heart disease, arthritis, cancer and many other common chronic diseases derive from the same source: fortuitous mutations caused largely by free radicals. Under optimum conditions, cells are protected against free radicals and lipid per oxidation. Antioxidants are substances, which react chemically with free radicals and render them harmless and at the same time break the vicious circle, which involves the decomposition of fatty acids & proteins, the creation of new free radicals and eventual cell death. Because free radical damage accumulates with age, people should start supplementing with antioxidants early to achieve long-term benefits. The scientific community has begun to unveil some of the mysteries surrounding this topic, and the media has begun whetting our thirst for knowledge.

Keywords: Antioxidant; Vitamin C; Vitamin E

1. Introduction

Athletes have a keen interest because of health concerns and the prospect of enhanced performance and/or recovery from injury due to exercise. The purpose of this article is to serve as a beginner's guide to what antioxidants are and to briefly review their role in exercise and general health. Traditional knowledge of medicinal plants has always guided the search for cures. In traditional drugs due to presence of antioxidants, property them contributing in cures of many diseases. The human body posses innate defense mechanisms to counter free radicals in the form of enzymes such as superoxide dismutase, catalase, and glutathione peroxide. VitaminC, vitaminE, selenium, β-carotine, lycopene, lutin and other carotinoids have been used as supplemantry antioxidantsplants secondary metabolites such as flavonoids and terpenoids play an important role in the defence against free radicals. list of Plants produces large amount of antioxidants to prevent the oxidative stress, they represent a potential source of new compounds with antioxidant .

1.1 Antioxidant[2]

Role of Antioxidants: An antioxidant is a chemical that prevents the oxidation of other chemicals. They protect key cell components by neutralizing the damaging effects of free radicals, Major source of antioxidants is traditional herbs which are taken by human in life. In a normal cell, there are appropriate oxidant : antioxidant balance can be sifted, when production of oxygen species is increased or when levels of antioxidants are diminished This state is called oxidative stress.

To counter the harmful effects of free radicals like Reactive oxygen species (ROS) and Reactive nitrogen species (RNS), antioxidant defense mechanism operates to detoxify or scavenge these ROS and RNS. Antioxidants, together with the substances that are capable of either reducing Reactive Oxygen Molecules (ROMs) or preventing their formation, from a powerful reducing buffer and affects the ability of the oxygen metabolites. All reducing agents, thereby form protective mechanisms, which maintain the lowest possible level of ROMs in the cell.

Antioxidant defense system against oxidative stress is composed of several lines, and the antioxidants are classified into four categories based on function as follows:[5]

- First line of defense is the preventive antioxidants, which suppress formation of free radical (enzymes such as glutathione peroxidase, catalase, superoxide dismutase: carotenoids, selenoprotein, lactoferrin, etc.)
- Second line of defense is the radical scavenging antioxidants suppressing chain initiation and/of breaking chain propagation reactions, i.e., radical scavenging antioxidants.
- Third category antioxidants are repair and denovo antioxidants (some production enzymes, repair enzymes of DNA, etc.)
- Fourth line is an adaptation where the signal for production and reactions of free radicals induces formation and transport of the appropriate antioxidant to the right site.

  Antioxidants act as radical scavenger, hydrogen donors, electron donor, peroxide decomposer, singlet oxygen quencher, enzyme inhibitor, synergist and metal-chelating agents.

Table 1: Different types of free radicals and their defense system[5]

Type of Free Radical or Oxidants	Defense System
Superoxide anion (O^2)	Superoxide dismutases
Hydroxyl radical (OH)	(SOD), Mn-SOD, Cu-Zn-SOD
Peroxy radical(ROO)	Tocopherols, Ubiquinone
Singlet oxygen ($^1O_2$)	Carotenoids
Hydrogen peroxide (H_2O_2)	CATALASE, Seglutathione peroxide(GPx)
Hydroperoxides (HOO)	GPx, Glutathione reductase
Transition metals (Fe^{2+},Cu^+)	Chelators

Both enzymatic and nonenzymatic antioxidants exist in the intracellular and extracellular environment to detoxify ROS.

1.2 Enzymatic Antioxidants:[7-8] :The first lines of defense against O_2 and H_2O_2 mediated injury are antioxidant enzymes like SOD, GPx, and CAT.

- **Superoxide dismutase (SOD):** Superoxide dismutase (SOS) is a family of metallo-enzymes that convert O_2 and H_2O_2 by the reaction:

$$O_2 + O_2 \rightarrow H_2O_2 + O_2$$

It is considered to be stress protein, which is synthesized in response to oxidative stress. SOD is the most important enzyme as it is found in all aerobic organisms and is also present in mitochondria & cytosol. There are four families of SODs: Cu-SOD, Cu-Zn-SOD, Mn-SOD and Fe-SOD enzyme and has been detected in a large number of tissues and organism, and is thought that it is present to protect the cell from damage caused by O_2.

Increased plasma level of SOD has been reported in various diseases. Breast cancer patients have been reported to possess increased levels of plasma copper and zine. Thus, increased production of SOD in various genetic diseases may be in response of higher production of free radicals in those diseases.

- **Glutathione peroxidase (GPx):** Glutathione peroxidase (GPx) is a selenium containing enzyme, which catalyses the reduction of H_2O_2 and lipid hydroperoxide (LO2H), generated during lipid peroxdation, to water using reduced glutathione as substrate. It is found in both cytosol and mitochondria and is a well-known first line of defense against oxidative stress, which in turn requires glutathione as a cofactor. It is involved in the generation of nucleotide precursors of DNA via the reduction of ribonucleotides to deoxyribonucleotides. GPx catalyses the oxidation of Reduced Glutathione (GSH) to Oxidized Glutathione (GSSG) at the expense of H_2O_2 , by its selenium dependency. Since, selenium is an integral component of GOx, the measurement of this enzyme has been used as a functional index of selenium level.

  Low levels of selenium have been associated with a high risk of cardiovascular diseases and cancer in humans. Plasma GPx activity was found to be significantly elevated with respect to the controls in breast cancer patients. The reason of higher GPx activity in breast cancer patients may be in response to higher production of ROMs.
- **Catalase (CAT):** Catalase (CAT) is present in most cells and catalyses the decomposition of hydrogen peroxide to water and oxygen. The mechanism of action is as follows:

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

CAT is found to act 104 times faster than peroxidase and is mainly localized in mitochondria and in subcellular respiratory organelles. CAT is found to be important in the inactivation of many environmental mutagens. Plasmid DNA strand scission causes by xanthine/xanthine oxidase (XO) has been reported to be prevented by both SOD and CAT enzymes. It also has a role in preventing chromosomal accompanied by significant

increase in IL-2, which correlated with increased lymphocyte production[35].

By using parenteral nutrition with w-3 fatty acids, following haemorrhagic shock, it was possible to prevent an increase in the release of PGE_2 , and maintain normal defensive functions of splenocytes and macrophages .

A rise in IL-2, as well as maintenance of postoperative interferon-production could be shown for surgical patients on parenteral w-3 fatty acids nutrition. These results indicated the positive influence of parenterally administering w-3 fatty acids to weakened post-operative and post-traumatic defensive functions.

An animal experiment on rabbits even showed that intravenous administration of 1.5gm fish oil per kg body weight per day increased the elimination of bacteria from blood, in comparison with soyabean oil.

Some internally generated sources of free radicals are

a) Mitochondria b)phagocytosis c)Xanthenes oxidase d) Inflammation e) Arachidonate pathways g) Exercise h) Ischemia/Reperfution injury

Some externally generated sources of free radicals are:

a) Cigarette smoke b) Radiation c) Industrial solvent d) Environmental pollutants e) Certain drugs and pesticides f) Ozone

The free radical diseases: Oxidative Or free radical injury is a fundamental mechanism of human diseases. Increasing evidence suggests that such injury is important in the pathogenesis of a diverse group of neurological disorders (Ebadi,2001) Various diseases/disorders linked to free radical and reactive oxygen species were listed in table1

Table 2: Major diseases/ disorders linked to free radicals[1, 9, 10]

Aging	Kidney diseases
Cancer	Liver diseases
Cardiac myopathy	Lung diseases
Cataract	Neurodegenerative diseases
Chronic granulomatous diseases	Nutritional deficiencies
Diabetes mellitus	Radiation injury
Immune system disorders	Skin disorders
Ischemia/reperfusion injury	Toxic states (xenobiotics, metal toxicity)

Table 3: Central nervous system disorders associated with reactive oxygen species

Amyotrophic lateral sclerosis	Multiple sclerosis
Alzheimer diseases	Parkinson diseases
Downs syndrome	

Counteracting free radical damage: The human body has mechanisms to counteract damage by free radicals and other oxygen species. These act on different oxidants as well as in different cellular components. Various antioxidant defenses were listed in table

Table 4: Natural antioxidant defenses

Antioxidant enzymes	Antioxidants	Metal binding proteins
Superoxide dismutase	Vitamin C,E	Albumin
Glutathione peroxidase	Carotenoids(β-carotene, lycopene,etc)	Ceruloplasmin
Catalase	Thiols,Bilirubin	Haptoglobin
	Flavonoids Ubiquinol	Metallothionein
	Uric acid	Trasferrin

Food rich in antioxidants: Antioxidants are abundant in fruits and vegetables as wells as in nuts, grains and some meats, poultry and fish. The list below describes food sources of common antioxidants

- Beta-carotenes is found in many foods that are orange in color, including sweet potatoes, carrots, cantaloupe, squash, apricots, pumpkin, and mangoes. Some green leafy vegetables including collard greens, spinach, and kale are also rich in beta- carotene.
- Lutein, better known for its association with healthy eyes, is abundant in green, leafy vegetables such as collard green, spinach, and kale.

Lycopene is a potent antioxidant found in tomatoes, watermelon, guava, papaya, apricots, pink grapefruits, etc. Estimates suggest that 85% of American dietary intake of lycopene comes from tomatoes and tomatoes products.

Selenium is a mineral but not an antioxidant nutrient. However, it is a component of antioxidant enzymes. Plants like rice and wheat are the major dietary sourcwe of selenium in most countries. The amount of selenium in soils, which varies by region, determines the amounts of selenium in the food grown in the soil. Animals the eat grains or plants grown in selenium- rich soil have higher levels of selenium in their muscle. In the united states, meat and bread are common sources of united states, meat and bread are common

sources of dietary selenium while brazil nuts also contain large quantities of selenium's.

Vitamins A is found in thre main forms: retinol (vitamin A), 3,4- didehydroretinol (vitamins A2), and 3-hydroxyretinol (vitamins A3). Food rich in vitamin A include liver, sweet potatoes, carrots, like, egg yolk and mozzarella cheese.

Vitamin C or ascorbic acid can be found in high abundance in many fruits and vegitables and is also found in cereals, beaf, poultry and fish.

Vitamin E or tocopherol is found in almonds, oils including wheat germs, sunflower, corn and soybean (oils) , mangoes, nuts, broccoli and other foods.

1.3 Plants Having Antioxidant Activity

Table 5: List of Medicinal Plants Shown to Have Antioxidant Activity

Plant Name	Part Used	Method of Screening	Mechanism of action
Acacia catechu	Bark	DPPH assay	Free Radical Scavenger[42]
Acanthus ilicifolius	Leaves	SOD, Hydroxy radical and lipid peroxidation assays	Free radical scavenger[41]
Achyranthes aspera	Whole plant	DPPH assay	Free radical scavenger[125]
Aconitum heterophylum	Bark	DPPH assay	Free radical scavenger[43]
Acorus calamus	Rhizomes	DPPH assay	Free Radical Scavenger[44]
Alchornea laxifolora	Roots & leaves	Thiocyanate Method	Free Radical Scavenger[45]
Allium sativum	Aerial parts, Roots	MDA, SOD,GSH Hydroxy radical assay	Inhibits lipid peroxidation[46]
Allium vienale	Aerial parts	MDS, SOD, Hydroxy radical assay	Free radical scavenger[46]
Aloe vera	Leaf gel	Hemolysis of RBC	Free radical scavenger[47]
Alpinia sp.	Roots & Rhizomes	Thiocyanate assay	Inhibits lipid peroxidation[125]
Anethum sowa Roxb.	Seed	DPPH assay	Free radical scavenger[125]
Anthriscus	Std Extracts	DPPH, lipid peroxidation assays	Free radical scaven- ging, inhibition of lipid peroxidation[49]
Artemisia abyssinica	Essential oil	DDPH, Lipid peroxidation assays	Free radical scavenger[24]
Argemone mexicana	Leaves	DPPH assay	Free radical scavenger[125]
Aristolochia bracteata Retz.	Leaf, Stem, Pod	DPPH assay	Free radical scavenger[125]
Artemisia afra	Essential oil	DDPH, Lipid peroxidationassays	Free radical scavenger[24]
Artemisia apiacea	Entire plant	MDA, SOD, GSH, TBA assay	Free radical scavenger[124]
Artemisia arborescens	Aerial parts	Oxidation of linoleic acid	Free Radical Scavenger[51]
Asparagus recemousus	Roots	SOD, TBARS assay	Membrane Protective[52]
Azadirachta indica	Stem bark	Hemolysis of RBC	Inhibit lipid peroxidation[53]
Baccharis coridifolia	Entire plant	Hydroperoxide, TBARS assay	Free radical scavenger[54]
Bacopa monniera	Stem, Leaves	SOD, CAT, GPX activity	Free Radical Scavenger[55-56]
Ballaota acetabulosa	Aerial parts	TBA Assay	Free Radical Scavenger[57]
Ballaota pseudodictamus	Aerial parts	TBA Assay	Free Radical Scavenger[57]
Boehmeria nivea	Entire plant	Lipid peroxidation assay	Free radical Scavenger[58]
Bombax malabaricum	Gum	DPPH assay	Free radical scavenger[125]
Brassica hancei	Entire plant	Hemolysis of RBC, SOD assay	Free Radical Scavenger[125]
Brassica juncea	Leaves	DPPH, TBA assay	Free Radical Scavenger[50, 60]
Burkea Africana	Bark	DPPH assay	Free Radical Scavenger, lipoxygenase inhibitor[61]
Caesalpinia sappan	Heart Wood	DPPH assay	Free radical scavenger[125]
Calamintha gladulosa	Entire plant	Hydroxy radical assay	Free radical scavenger[59]
Cassia auriculata	Leaf, Flower	DPPH assay	Free radical scavenger[125]
Cassia fistula	Pod	DPPH assay	Free radical scavenger[125]
Cassia tora	Seed	DPPH assay	Free radical scavenger[125]
Calycotome villosa	Aerial parts	Oxidation of linoleic acid	Free radical scavenger[51]
Centaurea calcitrapa	Whorls	DPPH assay	Free Radical Scavenger, inhibition of lipid peroxidation[62]
Centella asiatica	Entire plant	MDA, GSH, SOD, assays	Inhibition of lipid peroxidation[63-64]
Cetraria islandica	Lichen	Thiocyanate, SOD, DPPH, methods	Free radical scavenger[65]
Cinnamomum cassia	Bark	Anti-lipid peroxidation, SOD assay	Free radical scavenger[66]
Commicarpus chinensis	Leaf	DPPH radical scavenging activity	Free radical scavenger[125]
Commophora mukul	Guggulipid	Lipid peroxidation assay	Inhibition of lipid peroxidation[67]
Coriandrum sativum	Seed	DPPH assay	Free radical scavenger[125]
Cornus stolonifera	Entire plant	DPPH, XO assay	Free radical scavenger[68]

Coscinium fenestratum	Stem	TBARS, SOD, CAT, GSH, GPX & GST assay	Free radical scavenger, inhibition lipid peroxidation[69]
Costus discolor	Roots & Rhizomes	Thiocyanate assay	Inhibits lipid peroxidation[48]
Culcitium reflexum	Leaves	DPPH, lipid peroxidation assays	Free radical scavenging[70]
Cuminum cyminum	Seed	DPPH assay	Free radical scavenger[125]
Curcuma longa	Rhizome	Lipid peroxidation assay	Inhibition of lipid peroxidation [71]
Daphne gnidium	Leaves	Oxidation of linoleic acid	Free Radical Scavenger[51]
Dendrophthoe felcata	Leaves & roots	DPPH, Lipid peroxidation assays	Free radical scavenger[72]
Diospyros kaki	Entire plant	DPPH assay	Free radical scavenger[92]
Emblica officinalis	Fruits	SOD, CAT, GPX assays	Free radical scavenger[73]
Emilia sonchifolia	Leaves	TBARS, SOD, hydroxyl radical assay	Free radical scavenger[74]
Eucalyptus globules	Leaves	Oxidation of linoleic acid	Free radical Scavenger[51]
Fagopyrum esculentum	Seeds	Peroxide radical, SOD assays	Free radical scavenger[75]
Ficus bengalensis	Bark	DPPH assay	Free radical scavenger[76]
Foeniculum vulgarae	Seed	DPPH assay	Free radical scavenger[125]
Garcinia atroviridis	Root, Leaves, Trunk, Stem Bark	Thiocyanate, TBA assay	Free radical scavenger[77]
Gaultheria shallon	Fruits	DPPH, assay	Free radical scavenger[44]
Ginkgo biloba	Standardized extract	TBARS, SOD assays	Inhibition of lipid peroxidation[78]
Ginkgo biloba	Leaves	DPPH, assay	Free Radical Scavenger[79]
Glycyrriza glabra	Roots	DPPH, TBARS assays	Free radical scavenger[80]
Gongronema latifolium	Leaves	SOD, GSH assays	Inhibition of lipid peroxidation[81]
Guiera senegalensis	Galls	DPPH assay	Free radical scavenger[82]
Gymnema sylvestre	Leaf	DPPH assay	Free radical scavenger[125]
Helichrysum arenarium	Flowers	DPPH, Hydroxy radical assay	Free radical scavenger[82]
Hemidesmus indicus	Entire plant	XO, Hydroperoxide, activity	Inhibits lipid peroxidation[85]
Hippophae rhamnoides	Leaves, Fruints	GSH assay	Free radical scavenger[86]
Holarrhena antidysenterica Wall	Fruit	DPPH assay	Free radical scavenger[125]
Hypericum empetrifoilum	Aerial parts	TBA assay	Free radical scavenger [125]
Hypericum patulum	Whole plant	DPPH, Lipid peroxidation assays	Free radical scavenger, inhibition of lipid peroxidation[72]
Hypericum perforatum	Shoots	SOD, hydroxyl radical assay	Free radical scavenger[87]
Hypericum rumeliacum	Aerial parts	TBA assay	Free radical scavenger[83]
Hypericum triquetrifolium	Aerial parts	DPPH, TBA assays	Inhibition of lipid peroxidation[88]
Hypericum triquetrifolium	Aerial parts	TBA assay	Free radical scavenger[89]
Lberis amara	Seeds	DPPH, assay	Free radical scavenger[90]
Lafoensia pacari	Stem bark	DPPH, XO assays	Free radical scavenger[91]
Laminaria japonica	Entire plant	DPPH assay	Free radical scavenger[92]
Leopoladia comosa	Bulbs	DPPH assay	Free radical scavenger, inhibition of lipid peroxidation[62]
Licania licaniaeflore	Leaves	DPPH assay	Free radical scavenger[93]
Ligustrum lucidum	Fruits	Hemolysis of RBC	Free radical scavenger[94]
Mangifera indica	Leaves, bark	Lipid peroxidation assay	Free radical scavenger[71]
Mentha aquatica	Essential oil	DPPH and Hydroxy radical assays	Free radical scavenger[95]
Mentha longifolia	Essential oil	DPPH and Hydroxy radical assays	Free radical scavenger[95]
Micromeria graeca	Entire plant	Hydroxy radical assay	Free radical scavenger[59]
Momordica charantia Fruits	Fruits	DPPH assay	Free radical scavenger[71]
Mucuna pruriens	Seeds	TBARS, GSH, SOD, Lipid peroxidation assays	Free radical scavenger[96]
Murraya Koenigi	Leaves	SOD, CAT, GSH, GPX, GST, G-6 PDH, MDA assay	Free Radical Scavenger[60]
Myrestica fragrance	Seed	DPPH assay	Free radical scavenger[125]
Nigella sativa	Essential oil	DPPH, lipid peroxidation assay	Free radical scavengr[31]
Ocimum killimandscharicum	Aerial parts	DPPH, Lipid peroxidation assays	Free radical scavenger, inhibition of lipid peroxidation[72]
Ocimum sanctum	Leaves	Lipid peroxidation assay	Free radical scavenger, membrane protection[97]

Olea Europeans	Entire plant	Hydroxy radical, TBARS assay	Free radical scavenger, Inhibit lipid peroxidation[98-99]
Origanum dictamnus	Aerial parts	TBA Assay	Free Radical scavenger[57]
Origanum heracleosicum	Flowering tops	DPPH, assay	Free Radical Scavenger, inhibition of lipid peroxidation[62]
Osbeckia aspera	Leaves	DPPH, XO, TBA assays	Free radical scavenger[100]
Panax ginsean	Entire plant	SOD, Hydroxyl radical assays	Free radical scavenger[101]
Paullinia cupana	Entire plant	Lipid peroxidation assay	Inhibits lipid peroxidation[102]
Phellinus rimosis	Wood inhabiting fungus	Lipid peroxidation assay	Free radical scavenger[103]
Phlomis lanate	Aerial parts	TBA Assay	Free radical scavenger[57]
Phyllanthus emclica	Fruits	MDA, SOD assays	Free radical scavenger[104]
Pinus nigra Sulip. Pallsiana (Lamb)	Turpentine exudes	Thiocyanate, DPPH, SOD, assays	Free radical scavenger[105]
Piper betle	Leaves	TBARS, SOD, CAT assays	Free radical scavenger, Inhibition of lipid peroxidation[125]
Pluchea indica	Roots	SOD, Lipid peroxidation assays	Free radical scavenger[107]
Podophyllum	Rhizomes	GST, SOD, lipid peroxidation assays	Inhibition of lipid peroxidation[108]
Prunus Americana	Fruits	DPPH assay	Free Radical Scavenger[44]
Psoralea corylifolia	Seeds	Hemolysis of RBC, Lipid peroxidation	Free radical scavenger[109]
Quercus alba	Entire Plant	DPPH, XO assays	Free radical scavenger[68]
Rhoicissus digitata	Roots, Stem, Leaves	TBA, DPPH, XO, Metal ion chelating assays	Free radical scavenger, Meatal ion chelating activities[110]
Rhoicissus tomentaosa	Roots, Stem, Leaves	TBA, DPPH, XO, Meatl ion chelating assays	Free radical scavenger[110]
Rhus hirata	Entire plant	DPPH, XO assays	Free radical scavenger[68]
Roula aquatica	Entire plant	DPPH Assay	Free radical scavenger[42]
Salacia oblonga	Root	TBARS, SOD, CAT, GSH assays	Inhibition of lipid peroxidation[111]
Salvia pomfiera	Aerial parts	TBA Assay	Free Radical Scavenger[57]
Salvia ringens	Aerial parts	TBA Assay	Free Radical[57] Scavenger
Sambucus cerulea	Fruits	DPPH assay	Free Radical Scavenger[44]
Santalum album	Wood oil	GST activity	Increases GST activity and sulfhydryl (SH) leavels[71]
Sinomonium acutum	Stem	DPPH, SOD, Hydroxy radical assays	Free radical scavenger[112]
Smilex china	Rhizome	GSH, Lipid peroxidation assays	Free radical scavenger[113]
Sophora japonica	Seeds	DPPH, Lipid peroxidation assays	Free radical scavenger, Inhibition of lipid peroxidation[72]
Spartium junceum	Flowers	SOD, activity	Free radical scavenger[114]
Spirulina fusiformis (Blue green alges)	Flowers	MDA, Conjugated diene, hydro peroxide assays	Free radical scavenger[115]
Stachys spruneri	Aerial parts	TBA Assay	Free radical scavenger[57]
Swertia chirata	Aerial parts	Lipid peroxidation assays	Free radical scavenger[71]
Syzygium cumini	Fruits	DPPH, assay	Free radical scavenger[76]
Tamarix ramosissima	Entire plant	DPPH	Free radical scavenger[116]
Terminalia arjuna	Bark	DPPH, Lipid peroxidation assays	Free radical scavenger, Inhibition of lipid peroxidation[72]
Terminalia bellerica	Bark	DPPH, Lipid peroxidation assays	Free radical scavenger, Inhibition of lipid peroxidation[72]
Tetracera loureiri	Entire plant	DPPH, assay	Free radical scavenger[117]
Teuorium polium	Entire plant	Hydroxy radical assay	Free radical scavenger[59]
Tinospora cordifolia	Root	TBARS, GSH, CAT, SOD assays	Free radical scavenger, Inhibition of lipid peroxidation[118]
Tordylium apulum	Whorls	DPPH assay	Inhibition of lipid peroxidation[62]
Uncaria tomentaosa	Entire plant	TBARS, Hydro peroxide assays	Free radical scavenger[119]
Undarial pinnatifida	Entire plant	DPPH assay	Free radical scavenger [92]
Ursica dioica	Leaves	DPPH assay	Inhibition of lipid peroxidation [62]
Vaccinium myrtillus	Anthocyano side extract	Lipid peroxidation, SOD assays	Free radical scavenger, Inhibition of lipid peroxidation[120]
Valeriana oficinalis	Root	DPPH assay	Free radical scavenger[125]
Vitex negundo	Leaf	DPPH assay	Free radical scavenger[125]

Withania somnifera	Roots	Lipid peroxidation assay	Inhibition of lipid peroxidation[71,121]
Zingiber sp.	Roots & Rhizomes	Thiocyanate assay	Inhibits lipid peroxidation[48]
Ziziphora taurica	Essential oil	Phosphomolybdenum spectrophotometry method	Inhibits lipid peroxidation[123]

Conclusions

Currently there has been an increased interest globally to identify antioxidant compounds from plant sources which are pharmacologically potent and have low or no side effects for use in protective medicine and the food industry. Modern civilization, use of different chemicals, pesticides, pollutant, smoking and alcohol intake and even some of synthetic medicine increases the chance of disease due to free radicals. Plants produces large amount of antioxidants to prevent the oxidative stress, they represent a potential source of new compounds with antioxidant activity. More or less the free radicals plays a role in health of modern era and the diseases caused from free radical are becoming a part of normal life. Increasing knowledge in antioxidant phytoconstituents and include them in daily uses and diet can give sufficient support to human body to fight those diseases. Phytoconstituents and herbal medicine are also important to manage pathological conditions of those diseases caused by free radicals. Explore the antioxidant principles from natural resources; identification and isolation of those phytoconstituents are simultaneously presenting enormous scope for their better therapeutic application for treatment of human disease. Therefore it is time for us, to explore and identify our traditional therapeutic knowledge and plant sources and interpret it according to the recent advancements to fight against oxidative stress, in order to give it a deserving place. Science herbs are considered to have less or no toxic effects would be the best alternative methods when the normal level of antioxidant defense mechanism fails. Many herbal antioxidants are used in the form of neutraceuticals products.

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