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Medicinal plants with antioxidant activity – A review

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ABSTRACT:

The production of free radicals occurs continuously in all cells as part of normal cellular function. However, excessive production of free radicals can play a role in many diseases. Antioxidants prevent tissue damage caused by free radicals by inhibition of their production, scavenging them, or by promoting their decomposition. This review highlighted the natural sources of antioxidants to be used as beneficial supplements in prevention of many diseases.

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INTRODUCTION:

The body is constantly producing free radicals due to the regular use of oxygen. Oxidation is a chemical reaction that transfers electrons from one molecule to an oxidizing agent. Oxidation reactions are known to produce free radicals. These free radicals are responsible for the cell damage in the body and contribute to various kinds of health problems, such as heart disease, diabetes, macular degeneration, and cancer. Antioxidants are a class of chemical substances naturally found in our food that can prevent or reduce the oxidative stress of the physiological system. Plants are the major source of natural antioxidants. Many previous reviews revealed that medicinal plants are efficient sources of antioxidant and free radical scavenging activities [1-3].

Table 1. Medicinal plants with antioxidant effects.

Medicinal plant	Active extracts or compounds	Methods	Ref.
Achillea santolina	Hydroalcoholic extract	Lipid peroxidation inhibition assay and DPPH assay	7-9
Adiantum capillus-veneris	Leaf extract	Lipid peroxidation inhibition assay, ABTS and DPPH assays	10-13
Adonis aestivalis	Flavonoids, crude extract	ABTS and DPPH assays	14-16
Agrimonia eupatoria	Different extracts and fractions	ABTS and DPPH assays	17-18
Ailanthus altissima	Ethyl acetate (EtOAc) fraction	ABTS and DPPH assays	19-20
Alhagi maurorum	Aqueous extract	FRAP and DPPH assays	21-22
Allium cepa	aqueous extract	In vivo improve superoxide dismutase, catalase, glutathionperoxidase, and reduced glutathione	23
Allium sativum		DPPH, and inhibition of lipid peroxidation assays	24-25
Alpinia galangal	Extracts and essential oil	ABTS and DPPH assays and inhibition of lipid peroxidation assays	26-28
Althaea officinalis	Scopoletin (7-hydroxy-6-methoxy coumarin)	Inhibition of lipid peroxidation assay	29-30
Ammanniabaccifera	Methanolic extract	Inhibition of lipid peroxidation assay	31-32
Ammi visnaga	Butanolic extract	DPPH assay	33-34
Anchusa italica	butamol extract of *Anchusa italica*and two of the triterpenes' compounds	DPPH assay	35-36
Anthemis nobilis	Chamazulene, aqueous extracts	ABTS and Inhibition of lipid peroxidation assays	37-39
Antirrhinum majus	Absolute methanol extract	DPPH assay	40-41
Apium graveolens	leaf extract	NO, DPPH, ABTS, LPO, and HPO methods	42-43
Arachis hypogaea	Peanut peptide	DPPH assay	44-46
Arctium lappa	caffeoylquinic acid derivatives from the root	The antioxidant activities were measured in a hexane/2-propanol solution of methyl linoleate in the presence of a radical initiator	47-49
Artemisia campestris	Aqueous, Ethyl acetate extracts and essential oils	ABTS and DPPH assays and inhibition of lipid peroxidation assays	50-53
Asparagus officinalis	Juice, anthocyanins A1 and A2	Inhibition of lipid peroxidation and DPPH assay	54-55
Astragalus hamosus	Rhamnocitrin 4'-β-D-galactopyranoside (RGP) obtained from leaves	*In vivo* antioxidant enzymes	56-57
Avena sativa	Phenolic-rich fractions of oats and 3 avenanthramides compounds	DPPHassay, inhibition of lipid peroxidation	58-60
Bacopa monniera	Aqueous andalcoholic extract	DPPHassay, inhibition of lipid peroxidation and invivo antioxidant enzymes	61-63 .
Ballota nigra	Aerial parts extracts, diterpenoid and flavonoid	DPPH assay and inhibition of lipid peroxidation	64-66
Bauhinia variegate	crude extracts and fractions	DPPH assay	67-68
Bellis perennis	The the aerial parts	DPPH assay	69-71
Benincasa hispida	Seeds and fruit extracts	DPPH, ABTS and in vivo inhibition of lipid peroxidation	72-75
Bidens tripartitus	Crude extracts of the herb and flowers	DPPH assay	76-77
Brassica nigra	Crude extract	DPPH assay	78-79
Brassica rapa	Root extract and the carbohydrate derivatives of the roots	Inhibition of lipid peroxidation and DPPH assay	80-81
Bryophyllumcalycinum	leaf extracts	DPPH assay	82-83
Caesalpinia crista	Seeds extracts	Inhibition of lipid peroxidation and DPPH assay	84-86
Calamintha graveolens	Crude extracts of the leaves and flavanone glycosides	DPPH and inhibition of lipid peroxidation	87-88
Calendula officinalis	Crude extracts	DPPH, ABTS and *in vivo* inhibition of lipid peroxidation and effect on antioxidant enzymes	89-91

Calotropaprocera	Crude extracts, latex, flavonoids and phenols	DPPH and inhibition of lipid peroxidation	92-94
Canna indica	The aerial parts methanolic extract	DPPH assay	95-96
Capparis spinosa	Aerial part and root extracts	DPPH, ABTS, FRAP assays	97-99
Capsicum species	Crude extracts and flavonoids	DPPH, ABTS, FRAP assays and α -carotene-linoleic acid system	100-103
Carthamus tinctorius	Seeds extracts, serotonin and flavonoids derivatives	DPPH, FRAP assays and inhibition of lipid peroxidation	104-107
Carum Carvi	Seeds extracts and essential oils	DPPHassayand inhibition oflipid peroxidation,	108-111
Cassia occidentalis	The methanolic extracts of leaves, stems and seeds	DPPHassay, nitric oxide scavenging activity, β- carotene-linoleic acid model system, hydroxyl radical scavenging activity, reducing power, metal chelating activity and superoxide radical scavenging activity	112-114
Casuarina equisetifolia	Crude extracts	DPPH and FRAP assays	115-116
Celosia cristata	Ethanol extract	DPPH, ABTS and FRAP assays	117-119
Centaurea cyanus	Crude extract	Chemiluminescence"s method – system luminol/H_2O_2	120-121
Chenopodium album	Ethanolic leaf extract	DPPH assay	122-124
Chrozophora tinctoria	Methanol leaf extract	DPPH assay	125-126
Cicer arietinum	Crude seeds and roots extracts and lectin	DPPH and hydrogen peroxide radical, and *in vivo* effect on superoxide dismutase, catalase, GSH, increased MDA levels.	127-134
Cichorium intybus	Crude extracts and fractions,	(DPPH) and hydrogen peroxide radical, and in vivo effect on superoxide dismutase, catalase, GSH, increased MDA levels.	135-138
Citrullus colocynthis	Crude seeds extracts and flavonoids, isosaponarin, isovitexin and isoorientin 3'-*O*-methyl ether, isolated from the fruits	DPPH assay	139-144
Citrus species	The leaf extracts and leaf essential oil of *Citrus aurantifolia, Citrus medica, Citrus limonum*and *Citrus sinensis*	DPPHassay and inhibition of lipid peroxidation	145-153
Clerodendrominerme	Methanolic extract of the aerial parts, and compound -hydroxy-6,7,4′-trimethoxy flavones	DPPH Assay, reducing power assay and total antioxidant activity	154-156
Clitoriaternatea	Different solvent extractsof different parts	DPPH Assay	157-161
Colchicum candidum	Methanol and ethanol extracts	DPPH, ABST and FRAP assays	162-163
Convolvulus arvens	Crude extracts of the aerial parts	DPPH, ABST and FRAP assays	164-170
Convolvulus scammonia	The crude methanolic extract	DPPH Assay	171-172
Cordia myxa	Crude extracts	DPPH assay	173-175
Coriandrum sativum	Seed powder, essential oil and crude extracts	DPPH assay, lipoxygenase inhibition, phospholipid peroxidation inhibition, iron chelating activity, hydroxyl radical scavenging activity, superoxide dismutation, glutathione reduction and antilipid peroxidation	176-183
Cotoneaster racimiflora	Racemiside, scopoletin, 7,8-dimethoxy-6-hydroxycoumarin, 3,3',4'-tri-O-methylellagic acid, and cereotagloperoxide isolated from the ethyl acetate-soluble fraction	DPPH assay	184-186
Cressa cretica	*n*-Butanol, methanolic and ethyl acetate extracts	DPPH assay	187-189
Crocus sativus	petals, stigmas, entire flowersand crocin	DPPH, ABTS assay and *in vivo* antioxidant enzymes	190-198
Crotalaria juncea	Crude extracts	DPPH assay and *in vivo* antioxidant enzymes	199-200

Cuminum cyminum	Crude extracts and β-pinene, p-cymene, γ-terpinene, cuminaldehyde and cumin oils	DPPH assay and *in vivo* antioxidant enzymes	201-210
Cupressus sempervirens	The chloroform and methanol leaf extracts and essential oils	DPPH, ABTS assay and *in vivo* antioxidant enzymes	211-217
Cydonia oblonga	Crude leaves, fruits, pulps, peels and seeds, phenolic extracts and essential oils	DPPH assay, β-carotene–linoleic acid bleaching method, and lipid peroxidation inhibition assay	218-225
Cynodondactylon	Ethyl acetate, hexane, ethyl acetate, and methanol leaves extracts	DPPH, superoxide anion radical scavenging, nitric oxide scavenging assay, ferrous chelating ability, hydroxyl radical scavenging assay, hydrogen peroxide scavenging activity and ABTS assay	226-230
Cyperus rotundus	Extracts by different extraction solvents	DPPH, superoxide anion radicals, hydroxyl radicals, nitric oxide radical, hydrogen peroxide, in addition to property of metal chelating and reducing power.	231-233
Dactylocteniumaegyptia cum	Crude extract	DPPH method	234-235
Dalbergia sisso	ethanol extract of the bark; aqueous and methanol extracts of the stem bark	lipid peroxidation inhibitory (LPO), DPPH method	236-238
Datura fastuosa	different solvent extracts from the leaves	DPPH method, hydroxyl radical scavenging activity, reducing power assay, and β – carotene bleaching activity	239-241
Datura stramonium	Crude extracts	DPPH method	242
Daucus carota	Dry matter	TBARS and DPPH methods	243-245
Desmostachyabipinnata	methanolic extract	DPPH, nitric oxide, hydrogen peroxide, hydroxyl radical scavenging activities and DNA damage protection.	246-248
Dianthus caryophyllus	volatile oil	DPPH assay	249-250
Digitalis species	alcoholic extractof *Digitalis purpurea*	DPPH and the total antioxidant capacity	251-253
Dodonaeaviscosa	Ethanolic and Methanolic extractsextract	DPPH assay	254-255
Dolichos lablab	methanol extracts,	DPPH assay	256-257
Echinochloa crus-galli	Seeds and aerial parts extracts	DPPH assay	258-260
Echium italicum	Ethanolic extracts	DPPH, Fe^{2+}- chelating ability, total phenolic contents and total flavonoid contents methods.	261-262
Ephedra species	Methanolic extractof Ephedra*alata*	DPPH assay	263-264
Equisetum arvense	Aqueous and ethanol extract	ABTS and DPPH assays	265-268
Erigeron canadensis	Methanolic, hexane, chloroform, ethyl acetate, butanol and 70% ethanolic extract	DPPH and against nitrative and oxidative damage induced by $ONOO^-$	269-272
Erodium cicutarium	Methanolic, extract, tannin, gallic acid, (+)-catechin and vitamin C	DPPH assay	273-276
Eryngium creticum	Aqueous and ethanolic extracts from different parts (leaves, stems, roots, and the whole plant)	DPPH assay	277-279
Eucalyptus Species grown in iraq	The essential oil and the subfractions of methanol extract from leaves of *Eucalyptus largiflorens.* The leaves extract and essential oil of *Eucalyptus camaldulensis*	DPPH	280-284
Eupatorium cannabinum	The hydro-alcoholic extractandcaffeoyl derivatives	DPPH assay	285-287
Euphorbia hirta	different parts (leaves, stems, flowers and roots) extracts of *Euphorbia hirta*	DPPH assay	288-290
Euphorbia tinctoria	Extracts of the leaves and stems	DPPH assay	291-294
Fagopyrum esculentum	Seed components, epicatechin, (+)-	DPPH assay	295-298

	catechin 7-*O*-β-D-glucopyranoside, (−)-epicatechin 3-*O*-*p*-hydroxybenzoate, and (−)-epicatechin 3-*O*-(3,4-di-*O*-methyl) gallate		
Ficus carica	Leaves extracts, Cyanidin-3-rhamnoglucosideand crude hot-water soluble polysaccharide	DPPH assay	299-303
Ficus carica	Crude extracts	DPPH assay	304-305
Ficus religiosa	aqueous and ethanolic bark extracts	inhibition of lipid peroxidation assay	306-307
Foeniculum vulgare	Crude seeds extracts and 3-caffeoylquinic acid, 4-caffeoylquinic acid, 1.5-Odicaffeoylquinicacid, rosmarinic acid, eriodictyol-7-Orutinoside, quercetin-3-O-galactoside, kaempferol-3-Orutinoside, kaempferol-3-Oglucoside, hydroxylcinnamic acid derivatives, flavonoid glycosides and flavonoid aglycones	DPPH, FRAPassays and total antioxidant capacity	308-312
Fraxinus ornus	Ethanolic extractof *bark*, as well as esculetin, esculin, fraxetin and fraxin	DPPH assays and inhibition of lipid peroxidation	313-315
Fumaria officinalis	Methanolic extract of aerial parts	Ferric reducing antioxidant power assay, cupric reducing antioxidant capacity assay, DPPH radical scavenging, ß-caroten-linoleic acid assay, metal chelating capacity and inhibition of the organic compounds and the conjugated diene hydroperoxides arising from linoleic acid oxidation	316-319
Fumaria parviflora	Crude extract	In vivo, evaluation of SOD, glutathione Peroxidase and glutathione reductase	320-321
Galium aparine	Methanol, ethyl acetate and ethanol crude aerial parts extracts	DPPH assay, H_2O_2 scavenging assay and metal ion chelating ability	322-326
Galium verum	Aerial parts extracts	DPPH and nitric oxide radical scavenging, reducing power and H2O2 scavenging	327-331
Geum urbanum	Crude extracts of different parts	DPPH, FRAP assays and percentage inhibition of linoleic acid oxidation capacity	332-334
Glycyrrhiza glabra	Roots extracts and Chalcone derivative, a novel group of neolignan lipid esters, and seven known phenolic compounds (formononetin, glabridin, hemileiocarpin, hispaglabridin B, isoliquiritigenin, 4‘-O-methylglabridin, and paratocarpin B)	DPPH assay	335-339
Gnaphalium luteoalbum	Methanol extracts	DPPH assay	340-341
Gossypium Species	Hydroalcoholic, aqueous and ethanolic leaves extracts andgossypol	Free radical scavenging activity, reducing power assay, DNA damage prevention	342-346
Haplophyllum species	Aerial parts extracts and essential oils	β-carotene bleaching test, the reducing power test and H_2O_2 induced cell damage	347-350
Hedera helix	Ethyl acetate, methanol and dichloromethane stem extracts, methanol extract of leaves,methanolic extract of the whole plant and α-hederin, hederasaponin-C, and hederacolchisides-E and F.	DPPH assay	351-355

Helianthus annuus	Methanol and hexane extracts of seeds	Inhibition of peroxidation of lipids, hydroxyl radical formation and DPPH radical formation	356-359
Helianthus tuberosus	Leaves and tubers extracts	Total antioxidants, ABTS and CUPRAC methods	360-363
Helicophyllum crassipes (Eminiumspiculatum)	Aqueous extracts of the leaves	Lipid peroxidation (inhibition	364
*Heliotropium*Species	Leaves, flowers stems, and roots extracts	DPPH assay	365-367
Herniaria glabra and Herniariahirsuta	Methanol extracts	DPPH assay	368-369
Hibiscus cannabinus	Flowers extracts	DPPH free radical scavenging activity in vitro and their capacity to protect DNA from oxidative damage *in vivo*.	370-371
Hibiscus rosa-sinensis	Different leaves and flowers extracts	DPPH free radical scavenging activity and percentage inhibition of linoleic acid oxidation capacity	372-379
Hibiscus sabdariffa	Different calyx, petal, and leaf extracts	(DPPH) inhibition, lipid peroxidation inhibition and *in vivo* antioxidant status	380-391
Hyoscyamus species	Arial parts and leaves extracts	DPPH antiradical, nitric oxide scavenging and metal chelating activities	392-399
Hypericum triquetrifolium	aerial parts extracts	DPPH free radical scavenging, ferric Reducingand ferrous chelating,	400-404
Inula graveolens (Syn: Dittrichia graveolens)	Methanolic leaves extract, methanolic and acetone extract of aerial parts	DPPH assay and ferrous ion chelating	405-410
Jasminum officinale	Crude aqueous, methanolic and ethanolic leaves extracts	DPPH, NO, superoxide and ABTS radicals in addition to reducing power assessment.	411-415
Jasminum sambac	Methanol and ethanol extracts and essential oils	DPPH free radical scavenging, β-carotene-linoleic acid assays andhydrogen peroxide method.	416-420
Juglans regia	Water, chloroform, methanol, ethanol, ethyl acetate and N-butanol extracts of the leaves, water, hydroalcoholic, chloroform and petroleum ether of the bark and polyphenols	DPPH radical scavenging, reductive power tests, H2O2 scavenging activity, inhibition of lipid peroxidation andtotal antioxidant capacity	421-430
Juncus maritimus	Rhizomes extracts	DPPH assay	431
Juniperus communis	Water, ethanol extracts and essential oils	DPPH, ABTS, hydroxyl radical (OH•) scavenging and chelating capacity, superoxide radical (•O2−) scavenging, xanthine oxidase inhibitory effects and hydrogen peroxide scavenging.	432-436
Juniperus oxycedrus	Aqueous, ethanolic, methanolic extracts and essential oils	DPPH, TEAC, and FRAP	437-441
Jussiaea repens	Crude leaves extracts	DPPH assay	442-445
Kochia scoparia (Syn: Bassia scoparia)	Aqueous and 50% ethanol fructus kochiae extracts	DPPH radical assay, Superoxide anion radical scavenging activity and Lipid peroxidation inhibition assay	446-447
Lagerstroemia indica	Flowers and leaves extracts	DPPH, ABTS and FRAP assays	448-451
Lagerstroemia speciosa	Leaves and barks extracts	DPPH assay	452-455
Lallemantiaiberica	Ethyl acetate and methanol leaves extracts and essential oils	DPPH and FRAP assays	456-458
Lallemantiaroyleana	Seeds different extracts	DPPH and FRAP assays	459-460
Lantana camara	Extracts of leaves and Stem, lantadene A, oleanolic acid and lantanilic acid	DPPH, the total phenolic and flavonoids contents and total antioxidant activity	461-466
Lathyrus sativus	Crude extracts	DPPH scavenging activity, reducing power, β-carotene bleaching inhibition and TBARS formation inhibition	467-471
Lawsoniainermis	Leaves methanol, petroleum ether and	DPPH and ABTS assays	472-478

	ethyl Acetate extracts		
Lemna minor	lyophilized water and ethanol extracts	H2O2 scavenging activity, Ferrous ion chelating activity and Superoxide scavenging activity	479-480
Leonticeleontopetalum	Lupanine, a quinolizidine alkaloid isolated from the tubers	ABTS, FRAP and reduction power	481-483
Lepidium sativum	Methanolic, ethyl acetate and ethanolic extracts	DPPH, ABTS, superoxide scavenging activity and metal chelating property	484-489
Lippianodiflora	Defatted methanolic extract of aerial parts, methanol and ethyl acetate extract of leaf and stem	DPPH assay and inhibition of lipid peroxidation	490-494
Luffa acutangula	Ethyl acetate and ethanol extracts of dried leaves, peels and seeds extracts	DPPH, ABTS, superoxides radical, reducing power and phosphomolybdenum assay.	495-499
Luffa cylindriica	Chloroform, n-hexane, ethyl acetate, ethanol and methanol extracts of leaves	ferric thiocyanate test, thiobarbituric acid test, ferric reducing antioxidant power and DPPH free radicals scavenging test	500-504
Lycopus europaeus	Leaves waterand hydroalcholicextracts	DPPH and ABTS assays	505-507
Lythrumsalicaria	Methanolic and ethanolic extracts of the aerial parts	DPPH, nitric oxide and hydrogen peroxide scavenging activities	508-513
Malva neglecta	Leaves, stems, flowers and roots extracts	DPPH, FRAP and ORAC assays.	514-518
Mangifera indica	Aqueous-methanolic extracts of pulp, peel and seed kernels, many crude extracts, fractions (ethyl acetate and n-butanol) and many separated compounds	DPPH, FRAPassays, and inhibition of lipid peroxidation	519-527
Marrubium vulgare	Methanolic extract, essential oils and flavonoids (acacetin, apigenin, and acacetin-7-rhamnoside).	DPPH and nitric oxide antioxidant activity and LPO inhibition	528-532
Matricaria chamomilla	Crude extracts of different parts and polyphenolic-polysaccharide conjugates	Various antioxidant assays: DPPH, ABTS, linoleic acid emulsion, ferric ions reducing antioxidant power, ferrous ions chelating capacity, superoxide radical scavenging activity assays	533-537
Medicago sativa	Flowers extracts, raw seeds and germinated seeds	DPPH and FRAP assays	538-542
Melilotus officinalis	Hexane, 96 and 50% ethanol extract	DPPH assay and lipid peroxidation inhibition	543-546
Melissa officinalis	Hydroalcoholic extract and infusions	DPPH radical scavenging model and CUPRAC method	547-549
Mirabilis jalapa	Acetone, ethyl acetate, petroleum ether, methanol and ethanol extracts of leaves	The total antioxidant capacity, FRAP and DPPH tests.	550-553
Musa paradisiaca	The aqueous and ethanolic extracts	DPPH assay	554-556
Narcissus tazetta	Bulb and 11 compounds [tazettones C-G, (2S)-3′,4′-dihydroxy-7-methoxyflavan, (2S)-3′,7-dihydroxy-4′-methoxy8-methylflavan, (2S)-liquiritigenin 7-methyl ether, 8-methylnaringenin, farrerol, and cyrtominetin], isolated from the bulbs.	DPPH and FRAP assays.	557-559
Nasturtium officinale	Ethanolic extract, phenolic, flavonoid, and anthocyanin contents	DPPH, ABTS and Inhibition of lipid peroxidation assays	560-563
Nerium oleander	Essential oil and different extracts (water, methanol, water: methanol and acetone).	DPPH assay; β-Carotene/linoleic acid a bleaching assay and ferric reducing power assay.	564-567

Nicotiana tabacum	The extracts of the stem, flavonoids and polysaccharides.	DPPH, ABTS, and reducing power tests.	568-572
Ociumbasilicum	Flavonoids, polyphenols, essential oil and crude leaf extracts.	DPPH assay	573-578
Olea europea	Ethanolic, hydro-alcoholic and aqueous extracts of leaves, and phenolic compounds	DPPH, ABTS, total antioxidant capacity (TAC), xanthine oxidase (XO) inhibitory assays.	579-584
Ononis spinosa	Crude extracts and fractions	DPPH and ABTS assays.	585-588
Onopordonacanthium	Butanolic, ethanol, and acetone extracts from flowers and leaves	DPPH assay.	589-592
Orchis masscula	Polysaccharide and crude extracts	DPPH method and total antioxidant effect.	593-595
Origanum vulgare	The essential oil and aqueous, ethanolic and methanolic extracts	DPPH and ABTS assays.	596-600
Oxalis corniculata	Flavonoids, crude methanolic and ethanolic leaves extracts.	DPPH, nitric oxide radical scavenging activity and against MPTP induced oxidative stress.	601-605
Phoenix dacylifera	The fruit extracts and polyphenol, flavonoid, anthocyanin contents.	FRAP and DPPH assays.	606-612
Pruns armeniae	Fruits, water and methanol extracts of sweet kernels	FRAP	613-614
Ranunculussceleratus	Crude extracts of Ranunculus*sceleratus*	DPPH, FRAP, TEAC, CUPRAC and SNP (silver nanoparticle assay)	615-616
Ranunculus arvensis	Crude extracts of Ranunculus *arvensis*	DPPH	617-618
Reseda Species	Methanol extracts of the flowers and leaves of *Reseda lutea*	On the activity of catalase, glutathione-S-transferase, and glutathione peroxidase	619-620

Plant antioxidants are mainly polyphenols (phenolic acids, flavonoids, anthocyanins, lignans and stilbenes), carotenoids (xanthophylls and carotenes) and vitamins (vitamin E and C) [4-5].

The antioxidant effects of medicinal plants are determined by many chemical-based assays. Among these assays, some are based on the ability to scavenge stable free radicals, such as Trolox equivalence antioxidant capacity (TEAC), DPPH assay and, Folin–Ciocalteu regent assay, and some assays are based on the ability to reduce metal ions, such as ferric ion reducing antioxidant power (FRAP), and cupric reducing antioxidant capacity (CUPRAC). Meanwhile, HAT-based assays detect the ability of an antioxidant to quench free radicals by hydrogen donation, which is more relevant to the radical chain-breaking antioxidant capacity. HAT-based assays include oxygen radical absorbance capacity (ORAC), total radical trapping antioxidant parameter (TRAP), and inhibiting the oxidation of low-density lipoprotein (LDL) [6].

This review highlighted the natural sources of antioxidants to be used as beneficial supplements in prevention of many diseases.

CONCLUSION:

Antioxidants from plant sources are biologically active compounds that have medicinal and therapeutic values as alternatives to their synthetic analogues, due to their stability, cheapness, and lack of undesirable effects associated with their use. This review presented plant sources of antioxidants to encourage further studies on their effectiveness when used medicinally, their stability, their pharmacokinetics, and the possibility of side effects resulting from them.

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