



QUANTUM OVERVIEW OF INDIAN SPECIES': FREE RADICAL SCAVENGERS WITH HEALING ANTIOXIDANTS PROPERTIES'

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ABSTRACT

Natural antioxidants obtained from plants are essential for eliminating oxidative damage brought on by reactive oxygen species (ROS) and scavenging free radicals. These antioxidants, which are widely distributed in fruits, vegetables, grains, spices, and medicinal herbs, are important in preventing several illnesses, including diabetes, cancer, and cardiovascular disease. For instance, phenolic substances strengthen the antioxidant defense by neutralizing free radicals and giving hydrogen or electrons. The hunt for better, natural substitutes for synthetic antioxidants has escalated due to growing concerns about the health risks involved. Eating a diet high in antioxidants, particularly plant-based foods, strengthens the body's defences against oxidative stress and the diseases it causes. The significance of dietary antioxidants, their sources, and their roles in preserving health and averting chronic diseases are highlighted in this review.

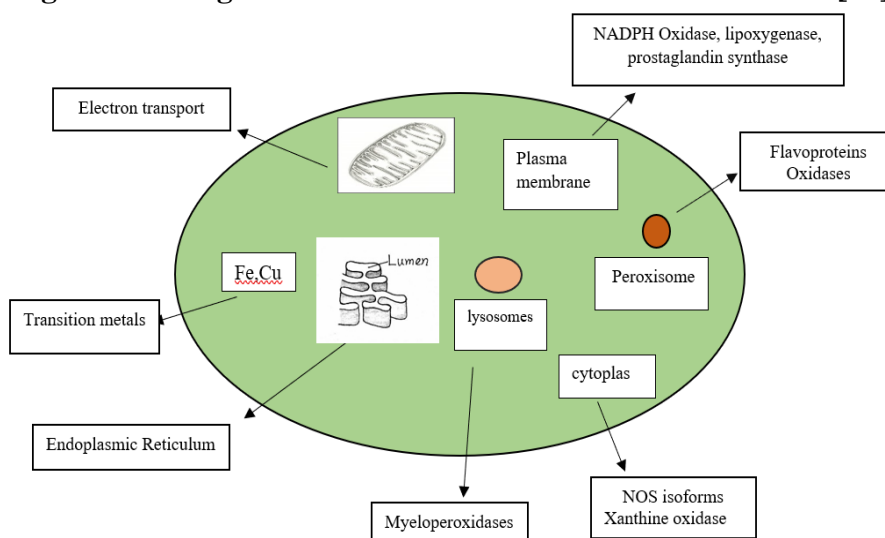
KEYWORDS: Free radical, Antioxidant, Geographical species

Introduction

Plant-derived natural chemicals can scavenge free radicals and display antioxidant capabilities [1]. Dietary or exogenous antioxidants are found in food and medicinal plants, such as fruits, vegetables, cereals, mushrooms, beverages, flowers, spices, and traditional medicinal herbs [2]. Roughly all plant species have good antioxidant potency, and two-thirds have medicinal significance. Plants can naturally biosynthesize a broad variety of non-enzymatic antioxidants that can reduce oxidative damage caused by reactive oxygen species (ROS). They consider completely stopping or slowing the oxidation of oxidizable substrates [3-4]. Eating foods high in natural antioxidants enhances an organism's antioxidant level [5]. They significantly defend against many infections and illnesses [6]. Phenolic molecules are essential to the process of oxidative stress. Because these substances are stable radical intermediates and can donate hydrogen or electrons, they are known to have antioxidant properties [3]. Nearly every cell in the human body undergoes free-radical reactions. Species extremely reactive and have an unpaired electron in their valence shell are known as free radicals [1]. They are organic and inorganic molecules with a short half-life that are extremely reactive and arise from regular physiological metabolism in the human body [7]. They mediate important biological

processes like growth, proliferation, differentiation, and death. Without strong antioxidant defenses, a significant concentration of free radicals could seriously harm cellular components [6]. There are four types of free radicals: oxygen-, carbon-, nitrogen-, and sulfur-centered radicals [8]. Some examples of reactive oxygen species (ROS) are hypochlorous acid, peroxyxynitrite (ONOO⁻), singlet oxygen, hydrogen peroxide (O₂), per-hydroxyl radical, nitric oxide, and hydroxyl radical, respectively. Some examples of reactive oxygen species (RNS) are nitrous acid (HNO₂), peroxyxynitrite (ONOO⁻), dinitrogen trioxide (N₂O₃), nitric oxide (NO[•]), nitrogen dioxide (NO₂[•]), and examples of RSS is sulfur species (SO₃^{•-}) [9]. Together endogenous (such as peroxisomes, phagocytic cells, mitochondria, peroxisomes, endoplasmic reticulum, etc.) and exogenous (such as heavy metals, alcohol, pollution, tobacco, smoke, industrial solvents, pesticides, transition metals, and some medications like halothane, paracetamol, and radiation) sources can produce free radicals [10].

Figure 1. Endogenous Sources of Free Radicals Productions [11]



Oxygen (O[•]2), Hydroxyl (OH[•]), Superoxide (O[•]-2), Peroxyl radical (ROO[•]), Alkoxyradical (RO[•]), nitrogen dioxide (NO[•]2), and Nitric oxide (nitrogen monoxide) (NO[•]), are some examples of radicals. These radicals are very reactive because they have one unpaired electron, making them want to give or take another electron to become stable. Hypobromous acid (HOBr), nitrosyl cation (NO⁺), Hydrogen peroxide (H₂O₂), hypochlorous acid (HOCl), dinitrogen trioxide (N₂O₃), singlet oxygen (1O₂), nitrous acid (HNO₂), nitrosyl cation (NO⁺), peroxyxynitrite (ONOOH), organic peroxides (ROOH), aldehydes (HCOR), nitronium (nitryl) cation (NO₂⁺), are some of the non-radical species. Although these non-radical species do not themselves contain free radicals, they can readily trigger free radical reactions in living things [12]. It is summarized in below Table 1 [13].

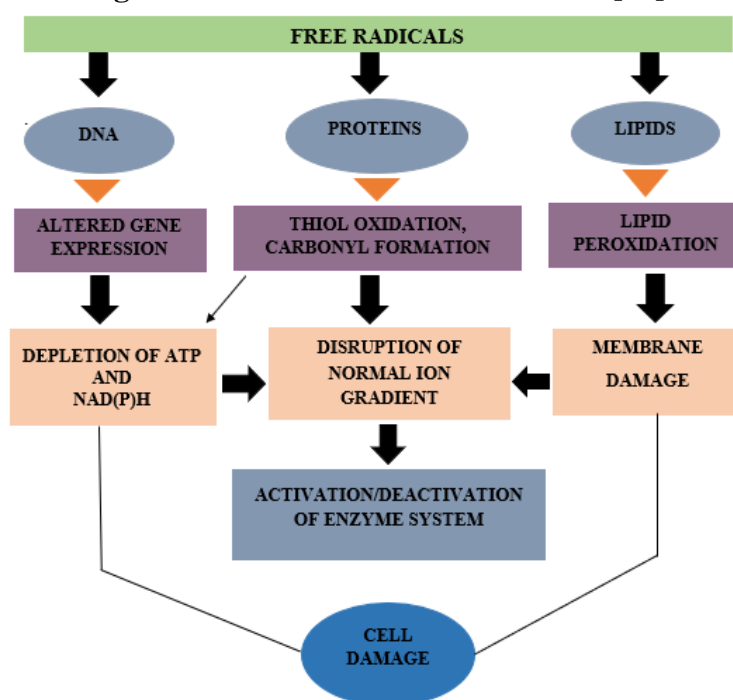
Table 1. Representation of Various Different Reactive Species

Reactive \species	Form	Example
Reactive oxygen species (ROS)	Radical	HO [•] , ¹ O ₂ , O ₂ [•] , HOO [•] , ROO [•] , RO [•] , CO ₂ [•] , CO ₃ [•]
	Non-radical	O ₃ , H ₂ O ₂ , HOCl, HOI, HOBr, ROOH, CO, ONOOH, ONOO, O ₂ NOO, HOOCO ₂ , (¹ D _g O ₂)
Reactive nitrogen species (RNS)	Radical	NO [•] , NO ₂ [•] , NO ₃ [•]
	Non-radical	ROONO, RO ₂ ONO, CH ₃ C(O)OONO ₂ , N ₂ O ₄ , N ₂ O ₃ , N ₂ O ₅ , NO ⁺ , HNO ₂ , NO ₂ Cl, NO
Reactive chlorine species	Radical	Cl [•]
	Non-radical	Cl ₂ , ClO ₂ , ClBr
Reactive sulfur species	Radical	S [•]
	Non-radical	H ₂ S, RS(O) ₂ SR, RSR [•] , RSSR

Production of free radicals in the human body

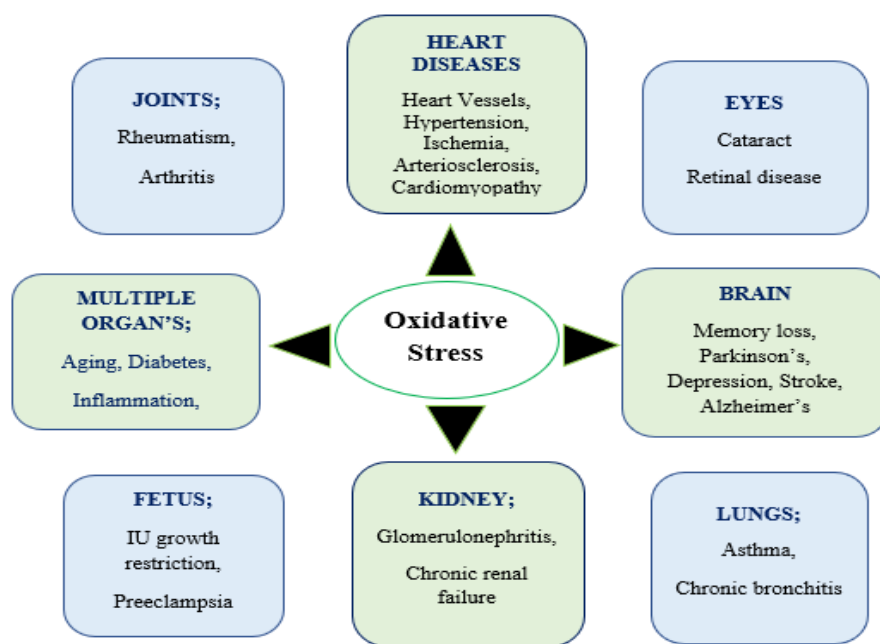
Free radicals and other ROS are produced by the body's normal metabolic processes as well as by external sources such as exposure to X-rays, ozone, cigarettes, air pollution, and industrial pollutants. The cells constantly produce free radicals as a result of both enzymatic and nonenzymatic processes. The respiratory chain's enzymatic processes, including phagocytosis, prostaglandin production, and the cytochrome P-450 system, are the source of free radicals. They can also be produced via nonenzymatic interactions between oxygen and organic molecules, in addition to ionizing events. Some internally generated sources of free radicals are Inflammation, mitochondria, certain drugs and pesticides, exercise, xanthine oxidase, industrial solvents, ischemia, peroxisomes, arachidonate pathways [13]. Thus, free radicals cause harm to proteins, lipids, and DNA and are responsible for several human diseases. Anemia, inflammation, cancer, and aging are the recurrent illnesses linked to free radical damage. Antioxidants protect the body from damage produced by free radicals. Numerous types of diabetes, neurological illnesses, cardiovascular diseases (CVDs), cataracts, asthma, rheumatoid arthritis, burns, intestinal tract diseases, progerias, ischemia, and post-ischemic pathologies are among the many pathological conditions that are linked to free radicals. [14-16].

Figure 2. Mechanism of Free Radicals [17]



A rise in the production of cellular free radicals relative to antioxidant levels within the cell causes an imbalance that causes the cellular milieu to shift toward an oxidant state, known as oxidative stress. It is caused by the body's overabundance of free radicals. An imbalance between the production and neutralization of reactive oxygen species (ROS) can result in the build-up of ROS intermediate products, which are harmful and can cause oxidative stress (OS) [18]. All the major macromolecules in the cell (proteins, lipids, carbohydrates, and DNA) undergo oxidative alteration as a result of these endogenous or external factors [19]. It is the primary source of tissue damage and a key factor in several severe illnesses, such as cardiovascular disease, neurological, diabetes, and liver cancer [13].

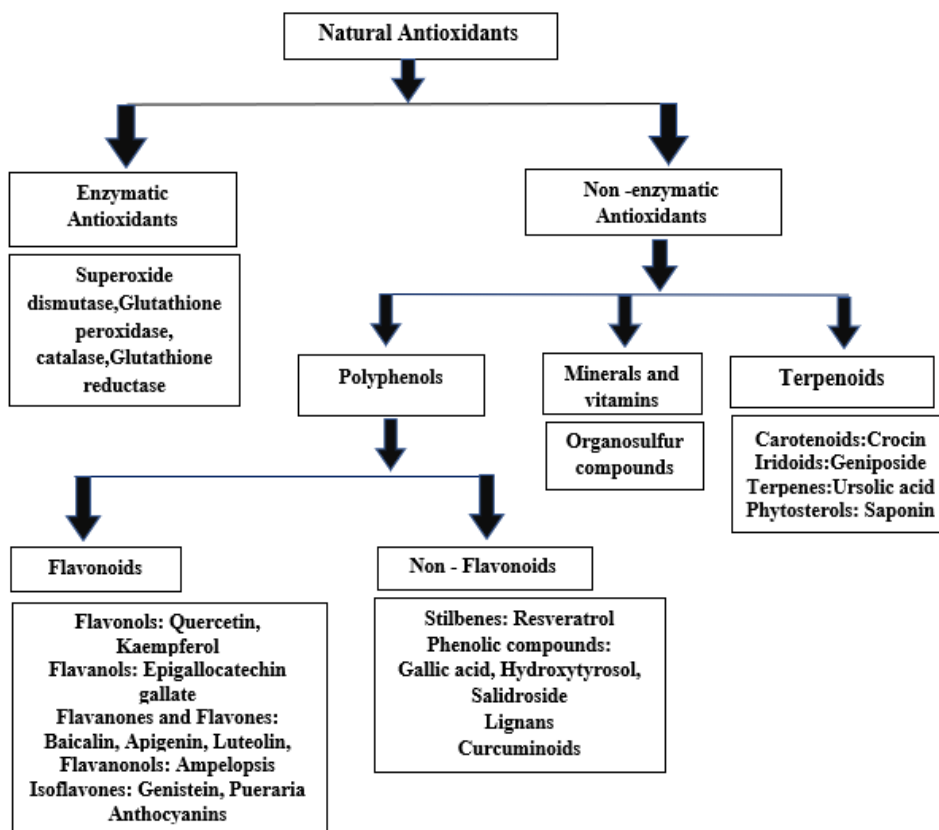
Figure 3. The Action of Oxidative Stress on Different Organs [20]



Antioxidants

Antioxidants are a class of compounds that particularly counterbalance reactive oxygen species (ROS) and free radicles in cells [21]. "Any substance that, when present at low concentration compared with those of an oxidizable substrate, significantly delays or prevents oxidation of that substrate" is the definition of an antioxidant put forth by Halliwell and Gutteridge [22].

Figure 4. Classification of Antioxidants [12]



Plants as a Source of Antioxidants















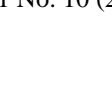
It has recently been reported that synthetic antioxidants pose a risk to human health. Thus, in recent years, there has been a greater focus on the quest for safe, natural chemicals that have antioxidative action. Consuming antioxidants obtained from food and plants seems to be a good substitute for endogenous antioxidant defense systems. One of the main sources of antioxidants is the diet and other plant materials. Increased consumption of foods with functional qualities, such as high levels of antioxidants in functional foods, is one technique that is gaining relevance. The traditional Indian diet, spices, and medicinal herbs are rich sources of natural antioxidants [23]. Their action through which phytochemicals' antioxidant effects commonly work includes donating hydrogen or electrons, scavenging free radicles, facilitating the decomposition of radicles of peroxy, and chelating divalent metals. As a result, they may slow or prevent the production of free radicals and the autoxidation process (a process that breaks chains of free radicals) [17].












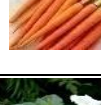


Functions of Antioxidants





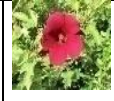






It is well recognized that antioxidants are essential to the protective effect that plant diets have. It has been established that eating fruits and vegetables regularly lowers the chance of developing chronic illnesses. A diet high in antioxidants is beneficial to health in the long run. Antioxidants have garnered a lot of interest lately about longevity, cancer prevention and therapy, and radicals and oxidative stress. Together, these antioxidants form the antioxidant system, which is in charge of guarding against the harmful effects of free radicals and the hazardous byproducts of their metabolism. Four potential pathways could slow down the oxidation rate of fats and oils. These include the antioxidants' contribution of hydrogen, their donation of electrons, the addition of lipids to the antioxidants, and the complex building between lipids and antioxidants. Phytochemicals, which are plant-derived compounds with consistent antioxidant potential, have received a lot of interest as food ingredients in the fight against chronic diseases. Plant foods have improved antioxidant effects because of the combined and synergistic actions of their bioactive components [24].












Table 2. Enlisting Antioxidant Indian species with their Botanical names, Chemical constituents, Medicinal uses, and their Reported activity.

Sl.no	Image	Plant name	Chemical Constituents	Medicinal use	Reported activity
1		<i>Abelmoschus esculentus</i> L Moench	Flavonoids, terpenes, fibers, phenolic acids, and, vitamins.	Wound healing, sore throat, neuroprotective, gastrointestinal irritation, and neuroprotective.	Antidiabetic, hypolipidemic, antioxidant, antimicrobial, and anticancer.
2		<i>Agaricus bisporus</i>	Flavonoids, terpenoids, polysaccharides, ergosteroids, fibers, minerals, and lectins.	Alzheimer's, diabetes, heart disease, and cancer.	Antidiabetic, antioxidant, and antihyperlipidemic effects.
3		<i>Allium cepa</i> L	Amino acids, fatty acids, phenolic acids, peptides, flavonoids, and saponins.	Cardiovascular disorders, inflammation, diabetes, headache, infections, respiratory disorders, and skin diseases.	Hyperlipidemic, neuroprotective activity, antioxidant, anti-cancer, anti-inflammatory, and antimicrobial.
4		<i>Allium sativum</i>	Diallyl sulfide, cysteine, allicin, vinyl di thiins, diallyl disulfide, and ajoene.	Cardiovascular diseases, diabetes, hyperlipidemia, and hypertension.	Anti-infective, antioxidant, antimicrobial, anti-cancer, antibiotic, antifungal, antiviral properties, antidiabetic, antiangiogenesis, and neuroprotective effects.
5		<i>Aloe vera</i>	Vitamins (vitamins A, C, E, and B12), Polysaccharides, anthraquinones, fatty acids, salicylic acids, aloin, emodin, saponins, and lignins.	To treat skin problems burns, wounds, and anti-inflammatory, diabetic, laxative, and hypoglycemia.	Anticancer, antioxidant, and antidiabetic.







6		<i>Anacardium occidentale</i> L. inn.	Anacardic acid, amino acid, fatty acid, ascorbic acid, phenolic acid, poly steroids, and flavanones.	Treatment of diarrhea, inflammatory diseases, acne, pain, analgesic antipyretic, and arthritis.	The genotoxic effect, hypoglycemic effect, and antioxidant.
7		<i>Anethum graveolens</i> L	Vitamin C, polyphenols, and carotenoids.	Liver diseases, glycogenic hepatopathy, gastrointestinal ailments, and gastroesophageal reflux disease.	Antioxidants, antimicrobial antispasmodic properties anticancer, antimicrobial, and anti-gastric irritation properties.
8		<i>Annona squamosa</i>	Terpenoids, tannins, fats and waxes, alkaloids, flavonoids, phenolics, and steroids	Ulcer, depression, cancer, antihelminthic antigenotoxicity, neuroprotective, and hepatoprotective	Anti-diabetic, and antioxidant, anti-bacterial, analgesic, anti-inflammatory, and antidepressant.
9		<i>Apricot kernel</i>	Volatile compounds, carbohydrates, vitamins, esters, carotenoids, and phenols.	Chronic inflammation, cancer, migraine, and blood pressure.	Anti-tumor, anti-asthmatic, antioxidant, analgesics, anticancer, and atherosclerosis.
10		<i>Asparagus racemosus</i>	Amino acids, steroids, glycosides, carbohydrates, tannins, saponins, flavonoids, and phenols.	Diarrhea, ulcers, diabetes, and jaundice.	Antioxidant, anti-inflammatory, antidiabetic, and anticholinesterase action.
11		<i>Avena sativa</i>	Avenanthramides, an indole alkaloid-gramine, steroids, terpenoids, tocopherols, and saponins.	Antispasmodic, antitumor, neurotonic, and diuretics.	Antioxidant, anti-inflammatory, anticholesterolaemic, wound healing, antidiabetic, and immunomodulatory.
12		<i>Averrhoa carambola</i>	Vitamins and minerals, gallic acid, and beta carotene.	Severe headache, cough, inflammatory diseases, skin diseases, fever, and diarrhea.	Antioxidant, hypocholesterolemic, anti-infective, hypoglycaemic, anti-tumor, and anti-inflammatory.
13		<i>Azadirachta indica</i>	Gallic acid, polysaccharides, nimbidin, nimbin, sodium nimbidate, nimbolide, and azadirachtin.	Vomiting, diarrhea, acidosis, drowsiness, and encephalopathy.	Antioxidant, anti-ulcer, anti-inflammatory, antifungal, antipyretic, and antidiabetic.
14		<i>Bersama</i>	Glycosides, steroids, xanthonoids, fatty acids, flavonoids, and terpenoids.	Blood purifier, malaria, hepatitis, stroke, psychotropic, meningitis, immune booster, and infertility.	Antioxidant, anti-inflammatory, antimalarial, cytotoxic activity antiviral, and anti-diabetic.
15		<i>Beta vulgaris</i> L	Flavonoids, phenolic acids, betalains, carotenoids, phenolic amides.	Antitumor, kidney and bladder stone, carminative, hemostatic, emmenagogue.	Antioxidant, anti-inflammatory, hepatoprotective, antihypertensive, and antidiabetic.
16		<i>Brassica oleracea</i>	Glucosinolates, sulforaphane, and indole-3-carbinol.	Hepatoprotective, antimicrobial cardioprotective, anti-amesic.	Antioxidant, antibacterial, anti-inflammatory, and anticancer.
17		<i>Brassica rapa</i>	Glucosinolates, isothiocyanates, erucic acid, indoles, terpenoids, tocopherols, and xanthoproteins.	Headaches, edema, rabies, syphilis, and gonorrhea.	Antioxidant, hepatoprotective, antihypotensive, anti-inflammatory, antitumor, and anti-diabetic.
18		<i>Calpurnia aurea</i>	Isoflavones, alkaloids, phenolic compounds, flavonoids, and terpenoids.	Dysentery, diarrhea, syphilis, wound, tinea capitis, and scabies.	Antioxidants, and antidiabetic activity.
19		<i>Camellia sinensis</i>	Polyphenols, polysaccharides, caffeine, and theanine.	Neuroprotective, coronary heart diseases, diabetes, and atherosclerosis.	Antioxidant, anticancer, hypoglycemic, antibacterial, antiviral, and neuroprotective.
20		<i>Capparis spinosa</i> L	Phenolic compounds, flavonoids, terpenes, tocopherols, and carotenoids.	Spleen disease, skin disease, kidney dysfunction, and gastrointestinal problems.	Antioxidant, antimicrobial, antidiabetic, anti-inflammatory, and anticancer.

21		<i>Capsicum annuum L</i>	Capsaicin, ascorbic acid, thiamine, fixed oil.	Cough, wound healing, immunomodulatory, antiseptic, sore throat, toothache.	Lipid-lowering, antihypertensive, antidiabetic, anti-obesity effects, and antioxidant.
22		<i>Cinnamomum verum</i>	Cinnamaldehyde, cinnamic acid, and cinnamate.	Anti-inflammatory, antiemetic, nematocidal, mosquito larvicidal, insecticidal, antimycotic, analgesic, Parkinson's, and alzheimer.	Antioxidant, anticancer, antiinflammatory, antimicrobial, and antidiabetic.
23		<i>Citrus aurantifolia</i>	Alkaloids, rutin, quercetin, nobiletin, hesperetin, triterpenoids, hesperetin, apigenin, kaempferol, naringenin, quercetin, and flavones.	Cardiovascular, hepatic, osteoporosis, and urolithiasis diseases, act as a fertility promoter, and insecticide activity.	Antibacterial, antioxidant, antiinflammatory, anticancer, antifungal, antilipidemia, and antidiabetic.
24		<i>Cocos nucifera L</i>	Phenols, saponins, flavonoids, tannins, polyphenols, triterpenes, alkaloids, steroids, leucoanthocyanidins, catechins, and epicatechins.	Diuretic, gonorrhoea, asthma, renal, inflammation, hepatoprotective, cardioprotective, vasodilation, and antiosteoporosis.	Anthelmintic, antiarrhythmic, and hypoglycemic activities. Antihypertensive, anti-inflammatory, antimicrobial, and antioxidant.
25		<i>Coriandrum sativum L</i>	Linalool, camphor, geranyl acetate, caryophyllene, and p-cymene.	Diabetes, joint pain, fighting worms, kidney and heart problems, and gastrointestinal.	Antidiabetic, antioxidant, and anti-inflammation.
26		<i>Cucumis sativus L</i>	Cucurbitacins, cucumerin A and B, orientin, apigenin 7-O-(6-O-p coumaroyl glucoside), vitexin, and cucumegastigmane.	Healing, cooling, anti-itching, irritant skin, refreshing, and soothing.	Antioxidant, antiwrinkle, antidiabetic, hypolipidemic, and antidiabetic.
27		<i>Cucurbita pepo</i>	Monounsaturated fatty acids, tocopherols, delta-7-sterols, oleic acid, polyunsaturated, linoleic acid, and beta-sitosterol.	Improving spermatogenesis, antimicrobial, antiulcer, anti-inflammatory, and wound healing.	Anti-inflammatory, antidiabetic, antioxidative, and antiviral.
28		<i>Curcuma longa L</i>	Curcuminoids, desmethoxycurcumin, bis-desmethoxycurcumin, and curcumin.	Wound healing, antioxidants, aging, cancer, antibacterials, and diabetes.	Antioxidant, anticancer, antimicrobial, antiulcer, and antidiabetics.
29		<i>Cyamopsis tetragonoloba</i>	Protein, fiber, carbohydrate contents, oil, polyphenols, tannins, and phytic acid.	Hypolipidemic, anorexia, antihyperglycemic, dyspepsia, and anti-secretory.	Antioxidants, anti-diabetic, antiparkinson, and anti-viral.
30		<i>Daucus Carota L</i>	Carotenes, xanthophylls, beta-carotene, lutein, hydrocarbons, and zeaxanthin.	Osteoporosis, cancer, cardiovascular diseases, aging, asthma, and neuroprotective.	Antioxidants, antidiabetics, cancer, and asthma.
31		<i>Datura</i>	Carotenoids, phenolic, glycosides, saponins, flavonoids, tannins, alkaloids, anthocyanins, terpenoids, and glycolipids.	Diabetes, antiviral, antioxidants, and obesity.	Antioxidant, antiviral, antimicrobials, obesity, bronchodilator, antiepileptic, and anticholinergic.
32		<i>Emblica officinalis Gaertn</i>	Ellagic acid, corilagin, gallic acid, elaeocarpusin, norsesquiterpenoids, pyrogallol, and prodelphinidins.	Fever, anti-inflammatory, peptic ulcer, stomachic, diuretic, dyspepsia, laxative, and liver tonic.	Gastroprotective, neuroprotective, antianemia, analgesic, antioxidants, antitussive, antiarrhythmic, antiatherosclerosis, cardioprotective, and anti-hypercholesterolemia.
33		<i>Eriobotrya japonica Lindl</i>	Starch, organic acid, phenolics, vitamins, flavonoids, tannins, carotenoids, proteins, minerals, and triterpenes.	Fevers, cough, vomiting, astringents, asthmatic, expectorants, and sedatives.	Antioxidant, inflammatory, diabetic, and anti-cancer.
34		<i>Erigeron annuus</i>	Caffeic acid, flavonoids, and coumarins.	Diabetes and enteritis.	Antifungal and antioxidative benefits.

35		<i>Evolvulus alsinoides</i> Linn	Tannins, phenols, alkaloids, proteins, steroids, terpenoids, saponins, and anthraquinone.	Memory tonics, nervous disability, epilepsy, brain tonic, and uterine bleeding.	Antifungal, antibacterial, antiulcer, anti-asthmatic, Antidiabetic, and antioxidant.
36		<i>Fernando adenophylla</i>	Diospyrin, 8-hydroxy isodiospyrin, pistagremic, and punicalagin.	Ammorrhoea, premature and nocturnal ejaculations, skin issues, sepsis, and treating infections.	Antioxidants, diabetics, fever, inflammation, cancer, infections, and hyperlipidemia.
37		<i>Foeniculum Vulgare</i> Mill	Estragole, trans-anethole, and fenchone.	Liver injuries, antioxidant, antiinflammatory, estrogenic, antidiabetics, anticancer, and cardioprotective.	Antioxidants, antibacterials, anti-parasitics, anti-inflammatory, and antifungal.
38		<i>Fragaria ananassa</i>	Ascorbic acid, tannins, essential oils, and flavonoids.	Hypercholesterolemia, gastrointestinal disorders, and strictures, anemia, diuretics, hepatitis, diarrhea, promoted intestinal and liver activity, arthritis, and kidney stones.	Anti-carcinogenic, anti-thrombotic, antioxidants, anti-apoptosis, antidiabetics, and anti-inflammatory.
39		<i>Hibiscus sabdariffa</i>	Flavonoids, polysaccharides, malic acid, tartaric acid, citric acid, carotenoids, tannins, anthocyanins, hibiscus acid, oxalic acid, phenolic acid, arachidic acid, ascorbic acid, and Chlorogenic acid.	Source of nutrients, liver disorders, antianemic, antioxidant, anti-inflammatory, cancer, antihypertensive, and nephroprotective.	Antioxidants, anti-lipidemic, hypotensive, and hypoglycemic.
40		<i>Ilex paraguariensis</i>	Caffeic acid, tannins, alkaloids, phenolic acid, chlorogenic acid, theobromine, quercetin, rutin, and kaempferol.	Diabetics, lower cholesterol, digestive disorders, and hypertension.	Antioxidant, antiobesity, cardiovascular activity, antidiabetics, chemopreventative, and digestive improvements.
41		<i>Ipomoea batatas</i>	Phenolic acids, anthocyanins, and caffeoylquinic acid derivatives Flavonoids, such as anthocyanins, flavonols, and flavones.	Antiinflammatory, antidiabetics, antimicrobials, cardiogenic, anticancer, antiprostatic, antifungal, and aphrodisiac.	Anti-diabetic activity, antioxidant, anticancer, antifungal, and antimicrobials.
42		<i>Juglans regia</i>	Flavonoids, terpenes, quercetin, glycosides, tannins, ascorbic acid, alkaloids, terpenoids, and caffeic acid.	Fever, skin diseases, malaria, diabetes, and rheumatic pain.	Antidiabetic, antioxidants, liver protective, and antimicrobial.
43		<i>Juniperus communis</i> L	Flavonoids, alkaloids, gums, aromatic acid, catechin, tannins, wax, resins, lignin, terpenic acid, organic acid, and leucoanthocyanidin.	Gastrointestinal and autoimmune disorders, antidiabetics, respiratory infections, gonorrhoea, cough, skin disorders, asthma, anti-arthritis, abdominal disorders, bladder infections, leucorrhoea, and amenorrhoea.	Antioxidant, antimicrobials, anti-inflammatory, hypoglycemia, cytotoxic, and hypolipidemics.
44		<i>Lactuca sativa</i> L	Chlorogenic acid, hydroxycinnamic acid, quercetin 3-glucoside, hydroxycinnamic acid, anthocyanin, quercetin 3-glucuronide, quercetin 3-malonyl-glucosides, and cyanidin 3-malonyl-glucoside.	Anti-diabetic, and anti-inflammatory.	Anti-diabetic, anti-inflammatory, and antioxidant.
45		<i>Lagenaria siceraria</i>	Sterols, proteins, choline, terpenoids, flavonoids, saponins, vitamins, and minerals.	Emetic, diuretics, purgative, rheumatism, cardiotonics, antidote, cooling, antibilious, sleeplessness, pectoral qualities, and aphrodisiac.	Antiinflammatory, anthelmintic, antioxidants, anticancer, antidepressant, antimicrobial, analgesic, anti-anxiety, cardioprotective, antiulcer, hepatoprotective, immunomodulatory, diuretic, cytotoxic, cardiovascular activity, and anti-urolithiasis.

46		<i>Cymbopogon</i>	Aldehydes, citral alpha, citral beta, terpinol methylheptenone, terpenes, citronellal, myrcene, ketones, terpinolene, alcohol, and geranyl acetate.	Antibacterials, antifungal, anti-inflammatory, anti-amoebic, antidiarrheal, and anti-filarial.	Antimutagenicity, neurobehavioral, antioxidants, antimalarial, hypoglycemic, and antimycobacterial.
47		<i>Malus pumila</i>	Procyanidin, gallic acid, coumaric acid, phloridzin, chlorogenic acid, quercetin-3-galactoside, catechin, quercetin-3-rhamnoside, and epicatechin.	Cancer, asthma, and type II diabetes, weight loss, and heart disease.	Antioxidant, anti-proliferative, cholesterol-lowering effects, and inhibition of oxidation.
48		<i>Mangifera indica</i> L	Manghopenal flavonoids, mangiferin, quercetin, indicoside A and B, polyphenols, rhamnetin glycoside, and kaempferol O-glycoside.	Cancer, skin infections, toothache, diarrhea, diabetics, cough, prostatitis, and urinary tract infections.	Antioxidant, anti-amoebic, and anti-inflammatory.
49		<i>Mentha</i>	Limonene, iso menthol, menthol, d-menthone, carvacrol, phellandrene, menthofuran, p-cymene, cineol, piperitone, carvomethone, neomenthol, pinene, isomethone, and menthylacetate.	Antibacterial, anticancer, antidiabetic, antioxidants, cough, and antifungal.	Anticarcinogenic, analgesic, antioxidant, anti-inflammatory, antiseptic, estogenic, antiallergic, and antiviral.
50		<i>Momordica charantia</i>	Triterpene, glycosides, alkaloids, lipids, proteins, karavilosides, steroids, inorganic phenolic compounds, polypeptide-p, charantin, and vicine.	Skin protection, anticancer, hypocholesterolemia, anticholesterol, and immunomodulation.	Anti-diabetic, antioxidants, anti-inflammatory, and atherosclerotic.
51		<i>Moringa oleifera</i>	Caffeoylguinic acid, beta carotene, quercetin, beta sitosterol, zeatin, vitamine C, and chlorogenic acid.	Hepatoprotective, wound healing, and analgesic.	Antidiabetics are anti-inflammatory, antimicrobial, antifertility, antioxidants, antiasthmatic, and anticancer.
52		<i>Nigella sativa</i> L	Terpenes, terpenoids, alkaloids, Polyphenols, phytosterols, and tocols.	Headache, inflammation, back pain, paralysis, asthma, amenorrhea, eczema, mental disability, anorexia, and hypertension.	Anti-inflammatory, antimicrobial, gastroprotective, anticancer, cardioprotective, nephroprotective, antihypertensive, hepatoprotective, antioxidants, antidiabetics, neuroprotective, and immunomodulatory.
53		<i>Ocimum sanctum</i> Linn	Eugenol, eugenol, carvacrol, limatrol, linallol, caryophyllene, methyl carvicol, estragol, and undec-4-ene.	Diarrhea, eye diseases, dysentery, insect bites, malaria, skin diseases, bronchitis, and arthritis.	Analgesic, adaptogenic, antioxidant, antispasmodic, anticancer, antifungal, antifertility, antidiabetic, antimicrobial, and cardioprotective.
54		<i>Olea europaea</i> L	Hiophenols, triterpenoids, lignan, phenolic acids, flavonoids, phenolic alcohols, secoiridois, oleuropein, rutin, and glucosides.	Leukemia, apoptotic effects, lipid-lowering, and antioxidants.	Antiproliferative, antioxidants, and anti-HIV.
55		<i>Phoenix dactylifera</i>	Flavonoid, sinapic acid, procyanidis, glycoside, ferulic, quercetin, p-coumaric, and luteolin.	Anti-inflammatory, antibacterials, and antioxidants.	Antioxidant, anti-cancerous, and anti-diabetic character.
56		<i>Piper nigrum</i> Linn	Piperine, N-piperoyl piperidin, alkaloids, and p-nigrum.	Gastric diseases, fevers, boils, urinary diseases, neuralgias, and respiratory diseases.	Antioxidant, antibacterial, and antimicrobial.

57		<i>Pisum sativum</i>	Flavonoids, hydroxy benzene, luteolin, saponins, quercetin, apigenin, hydroxycinnamic, glycosides, phenols, alkaloids, phytosterols, isoflavones, and phytic acid.	Antifungal, anti-inflammatory, anticancer, immunity, arthritis, digestion, antidiabetic, and antibacterials.	Antiinflammatory, antioxidants, anticancer, antimicrobial, antibacterial, antidiabetic, antidiabetics, and antihyperlesterolemia.
58		<i>Pistacia lentiscus</i>	Omega-3 fatty acid, oleic acid, phytosterols, vitamins, oils, mono-unsaturated, linolenic acid, and beta-sitosterol.	Diuretics, cough, kidney stone, sore throat, stimulants, hypertension, eczema, jaundice, and stomachache.	Sedative, antiatherogenic, and antioxidant properties.
59		<i>Polygonum senegalensis</i>	Flavonoids, tannins, and phenols.	Diabetes mellitus, hypertension, gynecological, and wound infections.	Antioxidant, an antibacterial, and antidiabetes potencies.
60		<i>Portulaca oleracea L</i>	Homoisoflavonoids, portulacanones A-D, sterols, flavonoids, fatty acids, minerals, alkaloids, vitamins, and polysaccharides.	Antispasmodic, diuretic, antimicrobial, skeletal muscle relaxant, analgesic, bronchodilator, wound healing, and gastroprotective.	Antioxidant, antispasmodic, antibacterials, anti-inflammatory, analgesic, diuretic, wound healing, antiseptic, antiasthmatic, skeletal muscle relaxant, antipyretic, and antibacterials.
61		<i>Psidium guajava L</i>	Gallic acid, flavonoids, ellagic acid, kaempferol, caffeic acid, quercetin, ferulic acid, Gauvin B, leucocyanidin, protocatechuic acid, chlorogenic acid, and phenolic acid.	Hypertension, inflammation, pain, and diabetes.	Anti-hepatic, antibacterial, antimalarial, antimycobacterial, antioxidants, antidiarrheal, antihyperglycemic, cytotoxic, and Anti-hyperglycemic activity.
62		<i>Rubus sp</i>	Flavonoids, flavanones, phenolic acid, anthocyanins, flavones, isoflavonoids, flavanols, tannins, and polyphenols.	Neurocognitive benefits, and Chemopreventive activity.	Antihyperlipidemic, anticancer, antiviral, antihypertensive, antiinflammatory, antiproliferative, and antibacterials.
63		<i>Salvia officinalis</i>	Borneol, thujone, cineole, tannin acid, ursolic acid, oleic acid, niacin, ursonic acid, nicotinamide, cornsole, fumaric acid, caffeic acid, cornsole, flavonoid glycosides, chlorogenic acid, and estrogenic acid.	Alzheimer's, hyperlipidemia, antioxidants, and anticancer.	Antioxidants, anticancer, antidiabetic, anti-inflammatory, antibacterials, and hyperlipidemia.
64		<i>Salvia hispanica</i>	Carbohydrates, proteins, dietary fiber, and lipids.	Lowering blood pressure, immune boosting, blood glucose level, and antimicrobial.	Antioxidant anti-cancer, and anti-diabetic.
65		<i>Sesamum indicum</i>	Sesame oil, sesamin, flavonoids, tocopherols, phytosterols, phenolic lignans, polyphenols, and sesamol.	Wound healing, lowering cholesterol, antioxidants, antibacterials, cancer, and hypertension.	Antioxidants, anticancer, antiinflammatory, antibacterials, and antidiabetics.
66		<i>Silybum marianum</i>	Silibin A, silibin B, taxifolin, silidianin, isosilibin B, silichristin A, and iso silybin A.	Treat liver and gallbladder diseases.	Hypoglycemic, hypolipidemic properties, and antioxidant.
67		<i>Solanum lycopersicum</i>	Vitamin C, beta carotene, chlorogenic, ferulic acid, folate, lycopene, phenolic acid, hydroxycinnamic acid, and homovanillic acid.	Skin health, immune response, healthy gut microbiome, and fertility.	Anticancer properties, cardiovascular, neurodegenerative diseases, and skin health, antioxidants.
68		<i>Solanum torvum Swartz</i>	Alkaloids, flavonoids, phenols, steroids, glycosides, and solasonine.	Diabetes, hypertension, tooth decay, inflammation, immune system, blood disorders, reproductive problems, cardiovascular	Hypoglycemic, antilipidemic, hepatoprotective activities, and antioxidants.

				disorders, cerebral disorders, oxidative stress, and cancer.	
69		<i>Swertia chirayita</i>	Xanthones, flavonoids, iridoids, terpenoids, alkaloids, hypoglycin, terpenoids, guanidine, carbohydrates, glycosides, glycopeptides, steroids, peptidoglycans, and polysaccharides.	Antihelmintic, analgesic, antimalarial, anticarcinogenic, anti-hepatitis, antimicrobials, and anti-inflammatory.	Antidiabetic and antioxidant properties.
70		<i>Syzygium aromaticum</i>	Gallotannic acid, eugenol acetate, alpha-copaene, vanillin, salicylate, chavicol, beta-yllangen, benzaldehyde, crategolicacid, beta-caryophyllene, eugeniin, kaempferol, methyl amyl ketone, eugenitin, rhamnetin, and oleanolic acid.	Anesthetic, burns, digestive disorders, gum infections, and respiratory disorders.	Anti-inflammatory, anticancer, antimutagenic, antioxidants, and antiangiogenic.
71		<i>Terminalia arjuna Roxb</i>	Flavonoids and triterpenoids.	Cardiac function, lower blood glucose level, regular blood pressure, and strengthen heart muscles.	Antioxidant, antibacterial, antimicrobial, antipyretic, antifungal, hepatoprotectives, antidysentery, antiinflammatory, abnormal platelet, and antitussive.
72		<i>Urtica dioica L</i>	Lignan, secolignan, norlignan, alkaloid, sesquiterpenoid, flavonoid, triterpenoid, sphingolipid, and sterol.	Antiinfectious, antiulcer, analgesic, hypotensive, cardiovascular diseases, and immunological atimulatory.	Anti-proliferative, anti-inflammatory, and antioxidant.
73		<i>Vitis vinifera</i>	Fatty acid, alpha-linolenic acid, and gamma-linolenic acid.	Cardiovascular disease, cancer, hypertension, and autoimmune disorders.	Cardiovascular, anti-inflammatory, anti-necrotic, anticarcinogenic, and antiapoptotic.
74		<i>Zizania spp</i>	Phytosterols, gamma-oryzanol, gamma-aminobutyric acid, phenolic acids, and flavonoids.	Cardiovascular, lipotoxicity, allergic, antihypertensive, and anti-inflammatory.	Anti-inflammatory, anti-allergic, anti-hypertensive, and immunomodulatory effects, and antioxidant activities.

Conclusion

Antioxidants derived from plants provide a safe, all-natural protection against oxidative stress, which is a major cause of many chronic illnesses. Their usefulness in a healthy diet is further demonstrated by their capacity to neutralize free radicals. The focus has switched to safer, natural alternatives as worries about synthetic antioxidants rise, highlighting the importance of fruits, vegetables, and medicinal plants in preventing disease.

In addition to promoting general health, a diet high in these antioxidants offers a long-term strategy for preventing oxidative damage and the diseases it causes. The synergistic effects of bioactive plant chemicals increase their potency, which is why antioxidants produced by plants are crucial for maintaining long-term health.

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