



NATURAL ANTIOXIDANTS, A SUPERFOOD FOR HEALTH AND WELL-BEING, A REVIEW

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Abstract: Purpose of this study is to outline the major categories of antioxidants found in fruits, drinks, vegetables, and herbs as well as how antioxidant-rich food can be used as a superfood to preserve health. Numerous review studies on antioxidants from various sources, along with methods for extraction and quantification, have been published recently. The aim of this review is to compile all the data, numbers, and facts into a single document for future researchers to review.

Finding fruits, vegetables, and drinks high in antioxidants are beneficial to human health since they reduce the risk of several diseases and can prevent heart disease and cancer. Plants are classed as antioxidants due to their capacity to scavenge several types of free radicals. Antioxidants, which stop oxidative destruction of oxidizable components, are a significant class of food additive that can extend the shelf life of food. Berries, vegetables, and drinks include antioxidants that help reduce the risk of acquiring various ailments, such as cardiovascular disease and cancer. They improve people's health as well. Because they may scavenge a variety of free radicals, substances produced from plants are categorized as antioxidants.

Keywords: Natural antioxidants, fruits, seeds, herbs.

INTRODUCTION

Superfood: More than 100 years after being coined, a term like superfood is virtually synonymous with presumptive health benefits. The term "superfood" is a fairly new term referring to foods that offer maximum nutritional benefits for minimal calories. They are packed with vitamins, minerals, and antioxidants which are considered beneficial to a person's health," according to the Merriam-Webster Dictionary Superfood are "functional foods that provide benefits that can either reduce the risk of disease and/or promote good health."^[1] The concept of a unique kind of food known as "superfood" was introduced in the 1990s, and with each restatement, there was a shared confidence in its significant nutritional superiority over other foods.^[2] The term "superfood" gained popularity due to an article published in the Wall Street Journal in 1992 titled "Report aims to whet the palate for superfood." The article defines this category in terms of "bioengineered food" as well.

DEFINITION OF ANTIOXIDANT: -Antioxidant means "against oxidation". Any substance at low concentrations significantly delays or prevents oxidation of that oxidizable substrate is called as antioxidant.

ANTIOXIDANT IN HUMAN HEALTH

- Antioxidants formed from nutrients, such as carotenoids, glutathione, lipid acid, and ascorbic acid (vitamin C), tocopherols and tocotrienols (vitamin E), and other low molecular weight molecules.
- Several additional antioxidant phytonutrients found in a large range of plant-based diets. For example, oligomeric Proanthocyanidins found in grapeseed extracts have been shown in clinical trials to have fifty times more potential than vitamin C in terms of tissue repair mechanism and bioavailability.^[3]

NEED OF ANTIOXIDANTS:

The effects of oxidation processes vary based on their location. Food deteriorates if an incident occurs within the food system. Oxidation causes harm or even death to cells in a biological system.

Lipids are thus exposed to initiators (light, metals, singlet oxygen, sensitizers (chlorophyll, hemoproteins, riboflavin), or preformed hydroperoxides breakdown products), which result in the production of primary hydroperoxides. Another consequence of lipoxygenase-catalyzed oxidation is hydroperoxides.^[4] In The addition of antioxidants is necessary to stop oxidative damage.

BENEFITS OF ANTIOXIDANTS

- Reduce the number of free radicals in our body.
- Reduce the risk of developing certain diseases such as cancer, heart disease, stroke, cataracts, Parkinson's, Alzheimer's and arthritis.^[5]
- Prevent direct cell damage caused by the chain reaction that free radicals initiate.

- Reduce the signs of aging by preventing the oxidation of skin cells.

CLASSIFICATION OF NATURAL ANTIOXIDANT

Natural antioxidants are those that can be found in foods that are naturally occurring, such as fruits, vegetables, and meats. Natural antioxidants can be found in many common foods.^[6] The most common ones are coenzyme Q10, also known as ubiquitin, which is a type of protein, and vitamin C (ascorbic acid), vitamin E (Tocopherols), and vitamin A (carotenoids), as well as various polyphenols like flavonoids, anthocyanin, and lycopene (a type of carotenoid).^[7] You can find natural antioxidants in most fresh meals.

Broadly, there are two major types of antioxidants as described below:

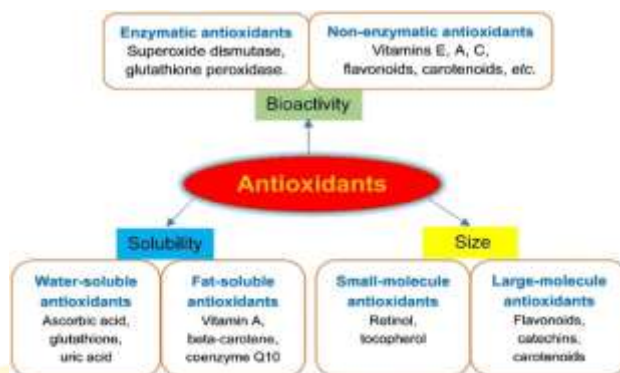


Fig. 1 Different classes of antioxidants

1. ENZYMATIC ANTIOXIDANTS

Enzymatic Antioxidants are enzymes that work by eliminating highly oxidative species (superoxide dismutase) or dissolve oxygen (glucose oxidase).^[8]

- COD (chemical oxygen demand)
- GPx (glutathione peroxide)
- GR (Glutathione reductase)
- G6PDH (glucose-6-phosphate dehydrogenase)
- SOD (superoxide dismutase)

2. NON-ENZYMATIC ANTIOXIDANTS

Nonenzymatic antioxidants Ascorbate plays a significant role in AsA-GSH (Asada Halliwell) cycle, the major antioxidant defense pathway to detoxify H_2O_2 . It scavenges ROS by its capacity to donate electrons and remain stable due to electron delocalization. GSH, plays a significant role in the regulation of AsA-GSH cycle towards scavenging cellular ROS and maintaining redox homeostasis. Carotenoids scavenge harmful free radicals, and protect light-harvesting complex proteins and are also responsible for the membrane stability. Flavonoids, flavones and flavonols scavenge free radicals and reduce cell damage from lipid peroxidation. Some examples of non-enzymatic antioxidants are^[9]

VITAMINS

The trace minerals that the body needs for regular physiological functions are vitamins. The majorities of vitamins are not synthesized by the human body and must be received through diet. The vitamins C and E are the most studied and well-known antioxidants. Fresh fruits and vegetables are the main source of vitamin C.^[10] Vitamins present in fruits and vegetables play a crucial role in human nutrition since they have specialized functions in the body's correct operation. Independent of their antioxidant qualities, the molecular mechanisms by which these substances function as anti-inflammatory and anticancer medicines are explored. Estimates suggest that men should take 90 mg of AA (AA=L-ascorbic acid) daily and women 75 mg. Ex. Vitamin E, Vitamin C, Vitamin A etc.

CAROTENOIDS

Antioxidants in Carotenoids, as highly lipophilic molecules, are typically located inside cell membranes.^[11, 12] Lipid soluble hydrocarbons are a class of molecules that contain oxygenated derivatives of carotenes, or carotenoids, and their carotenes, or xanthophyll. Since these compounds are present in numerous roots, the majority of yellow and red fruits, and green leaves, they are also widely distributed in many other plants. Many studies have found a connection between carotenoids and a decreased risk of developing a variety of cancers, such as lung, breast, prostate, and head and neck diseases.^[13]

Ex. Lycopene, Zeaxanthin, Essential amino acids etc.

POLYPHENOL

Polyphenols are naturally occurring compounds found largely in the fruits, vegetables, cereals and beverages. Fruits like grapes, apple, pear, cherries and berries contains up to 200–300 mg polyphenols per 100 grams fresh weight.^[14, 15] Typically, a glass of red wine or a cup of tea or coffee contains about 100 mg polyphenols. Cereals, dry legumes and chocolate also contribute to the polyphenolic intake. Ex. Flavonoids, Curcumin, Gingerol etc.

MINERALS

In geology and mineralogy, a mineral or mineral species is, broadly speaking, a solid substance with a fairly well-defined chemical composition and a specific crystal structure that occurs naturally in pure form.^[16] Ex. Iodine, Zinc, copper etc.

MECHANISM OF ANTIOXIDANTS IN THE HUMAN BODY

Reactive oxygen species (ROS) are results of increased mitochondrial activity that cause oxidative stress in cells. The cellular response promotes intracellular signaling at low ROS levels. None the less, if the ROS is strong enough, cell death might happen. As a result, to combat the accumulated ROS, a strong antioxidant defense mechanism is required. As the principal antioxidants, glutathione (GSH) and nicotinamide adenine dinucleotide phosphate (NADPH) help keep cells' oxidation-reduction and oxygen levels stable. NADPH can function as a shared substrate for either ROS creation or GSH regeneration. It is produced by the pentose phosphate metabolic pathway, among other pathways. Natural antioxidant enzymes like glucose-6-phosphate dehydrogenase and glutathione-S-transferase scavenge oxidative metabolites to shield red blood cells.^[17]

- Transfer reactions of hydrogen atoms
- Reactions of a single electron transfer.^[18]

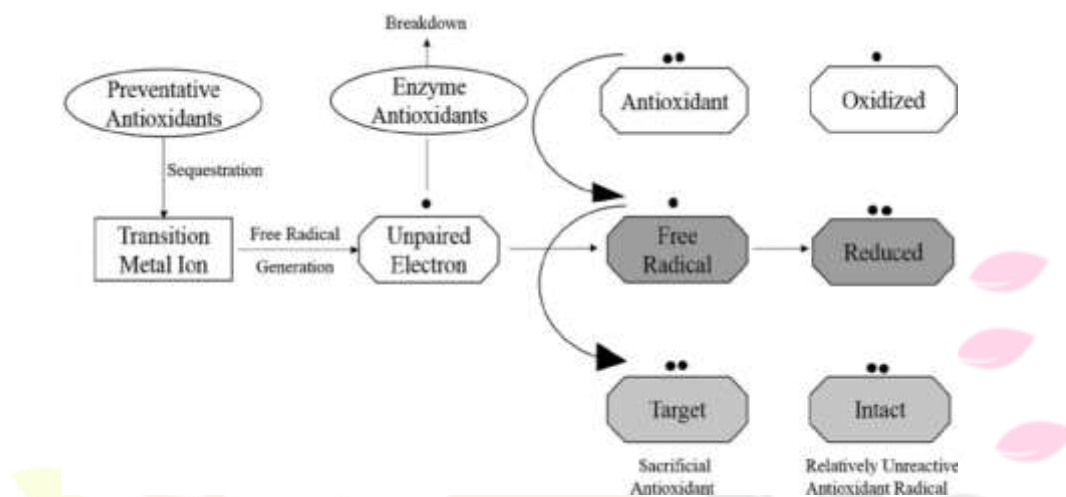


Fig. 2 Mechanism of action of antioxidants (adapted from kalam et al., 2012).

ANTIOXIDANT CONTAINING FRUIT, SEEDS AND HERBS ARE MAINTAINING HEALTH

Silymarin (Milk Thistle)

The thistle *Silybum marianum* is one kind. The plant is also referred to as Mediterranean milk thistle, Blessed milk thistle, Marian thistle, Mary thistle, Saint Mary's thistle, and Milk Thistle, in addition to its popular name, Scotch thistle (which should not be confused with *Onopordum acanthium* or *Cirsium vulgare*). It is an annual or biennial plant belonging to the Asteraceae family. This thistle is fairly common, having reddish-purple blooms and glossy, pale green leaves with white veins. Though originally native to Southern Europe and Asia, it is now found all over the world. Total silymarin and silymarin combination peroxyl radical antioxidant activity was measured and expressed as equivalent to trolox, a water-soluble vitamin E analogue.^[19] Silymarin, an antioxidant polyphenol, is extracted from the seeds of the milk thistle plant. It consists of three structural isomers: (i) silybin and isosilybin, (ii) silydianin and isosilydianin, and (iii) silychristin and isosilychristin, along with trace number of taxifolin and quercetin. It was discovered that the primary ingredient in the silymarin mixture, silybin or Silibinin, has anti-inflammatory and antioxidant qualities that can be used to treat neurological, cardiovascular, hepatic, and tumour disorders. Silymarin has a greater potential for hepatoprotection than aminoguanidine.^[20, 21]

Teucrium Polium L. (Felly Germander)

It's a member of the Lamiaceae family. The western Mediterranean region, which encompasses Albania, North Macedonia, Spain, France, Algeria, Morocco, and Tunisia, is home to the sub-shrub and plant *Teucrium polium* L, sometimes known as felly germander. It's tiny, pink to white blooms is used in medicine and cookery, and its leaves have a variety of applications. Natural antioxidants like polyphenols, flavonoids, carotenoids, tocopherols, and ascorbic acid are linked to the anti-inflammatory properties of medicinal plants.^[22, 23] For example, lipid peroxidation of an alcoholic *T. polium* extract in red blood cells has been shown to reduce hydrogen peroxide. Additionally, it has been shown that the extract can prevent the oxidation of beta-carotene and Fe+2, which causes rat liver homogenates to become inflamed and increases the amount of intracellular GSH.^[24]

Wheat

Worldwide consumption of wheat, a common grass farmed for its seed, makes it a staple crop. Numerous wheat species belong to the genus *Triticum*. It is most commonly grown as common wheat, or *Triticum aestivum*. According to botany, wheat kernels belong to the fruit class caryopsis. Pertains to the Poaceae plant family, specifically the Gramineae family. Including the well-known antioxidants tocopherol, carotenoids, and phenolic acids (vanillic and ferulic acids). Together with flavonoids and phenolic acids, wheat grains also contain other phyto-antioxidants.^[25] Although debranned wheat grain has a lower phenolic content and less antioxidant activity than wheat bran, the phenols and flavonoids in flour and bakery products are reduced since current milling techniques remove a large portion of wheat bran and germ. Flours generated at 60% and 100% extraction rates, respectively, had phenolic acid levels of 54 and 695 µg/g. Because regular consumption of whole wheat products could greatly reduce the risks of cardiovascular disease and cancer, the whole-wheat or slow milling process was developed to preserve

valuable biochemicals. Due to their nutritional and biochemical qualities, whole wheat flour and partially debranded wheat flour made from black wheat are regarded as healthy options. Curcumin (C₁₂H₂₀O₆), also known as methane dihydrochloride, is a polyphenol with the following formula and hydrophobic characteristics: 1, 7-bis (4-hydroxy-3-methoxyphenyl) - 1E, 6E-heptadiene-3, 5-dione, or diferuloylmethane. By lessening the cytotoxic effects of free radicals, polyphenolic compounds strong antioxidant biochemicals can enhance health. [26, 27]

Curcuma Longa (Turmeric)

Turmeric, scientifically known as *Curcuma longa*, is a flowering plant belonging to the Zingiberaceae family. This perennial herbaceous plant, native to Southeast Asia and the Indian subcontinent, requires substantial annual rainfall and temperatures between 20 and 30 °C (68 and 86 °F) in order to thrive. Made up of the antioxidant curcumin, several phenolic compounds, and flavonoids. [27] Curcumin, the primary component of turmeric, also contributes the colouring qualities. Turmeric powder tastes like hot, spicy black pepper. Control of nitric oxide and proinflammatory cytokines. [28] Which is commonly used to treat a variety of illnesses. Turmeric rhizome powder, called Zard Choohe in Persian, is a popular culinary spice that lends meals a distinct flavour and yellow hue. In addition, the antibacterial, antioxidant, anti-inflammatory, and anti-cancer, anti-obesity, neuroprotective, cardioprotective, and lipid-lowering properties of dried turmeric rhizome are employed in traditional medicine. [29] It is being tested by the National Cancer Institute as a chemopreventive medication. Although curcumin I (diferuloylmethane) makes up the majority of curcumin, it also contains curcumin II (6%) and curcumin III (3%) (0.3%). Curcumin's demethylated derivatives are among the most effective lipid peroxidation regulators; total methylation of these compounds renders them completely inactive as antioxidants. Curcumin I, II, and III, at doses of 20 pg/ml, 14 pg/ml, and 11 pg/ml, respectively, can decrease lipid peroxidation by 50%. This study shows that the demethylation of curcumin, as observed in curcumin III, boosts one's antioxidant activity. The synthetic type of derivatives of curcumin I (14 pg/ml) and curcumin III (13 pg/ml) were equally as effective as the natural substances investigated. Another curcumin III isomer that has produced reliable results is salicyl curcuminoid. [30]

Crataegus, Potentilla, and Rubus Plants (Whitehorn)

The hawthorn, sometimes known as whitehorn, may bush, or just haw, is a fruit-bearing shrub with vivid red berries, white blossoms, and bright green leaves. It is belonged to the Rosaceae family. Temperate regions of North America, Asia, Europe, and the Northern Hemisphere are among its natural habitats. It contains cyanidin-3-O-glucoside (CG) and epicatechin, two well-established antioxidants. Because of their high phenolic contents and several well-known antioxidant components, such as hyperoside, is quercetin, epicatechin, chlorogenic acid, quercetin, rutin, protocatechuic acids, and the fruits of various *Crataegus* species may be regarded as a rich source of antioxidants. [31, 32, 33] Few phenolic acids, 1%–2% flavonoids, and 2%–3% proanthocyanidins are found in *Crataegus*. *Crataegus* is particularly significant to the pharmaceutical sector because it contains bioflavonoids and proanthocyanins, which are natural antioxidants that are utilised in the treatment of cardiovascular illnesses. Plants such as terpenoids and other phenolic components, are abundant sources of secondary metabolites in potentilla and rubus plants. The potentilla and rubus polyphenols are useful due to their high antioxidant potential. Their effects in preventing oxidative stress-related disorders, such as diabetes, cancer, and inflammation, are remarkable. Several components and possible extracts have been reported to possess antioxidant, anti-inflammatory, antibacterial, anti-cancer, and anti-diabetic properties. [34]

Genus Vitis (Grape)

Within the Vitaceae family, the *genus Vitis* has 60–80 species of vining plants that are native to the North Temperate Zone. This genus has table fruit, raisins, grape juice, and wine among its varieties. Native to the Mediterranean region, Central Europe, and southwest Asia are common grape vines, or *Vitis vinifera*. They are found in southern Germany and Iran in the east, and in Morocco and Portugal in the north. Only a small percentage of the 5,000–10,000 distinct varieties of *Vitis vinifera* that exist today are suitable for use as table grapes and wine. There are polyphenol antioxidants which are found in grape pulps, have been studied extensively for their potential to protect diseases including cardiovascular disease. [35, 36] Proanthocyanidins, oligomers or polyhydroxy flavan polymers, are constituents of grape seeds in large quantities. These substances' colonic and conjugated metabolites are thought to have positive health benefits. Proanthocyanidins in grape seeds and the gut microbial flora most likely have a mutually beneficial connection. Furthermore, numerous *in vitro* and *in vivo* investigations have demonstrated the proanthocyanidins' pharmacological effects in grape seeds. These substances have been shown in the literature to have anti-cancer, antimicrobial, antioxidant, anti-obesity, anti-diabetic, anti-osteoarthritis, cardioprotective, and anti-neurodegenerative and neuroprotective properties. The protective properties of grape seed procyanidin, both as an oligomer and polymer, against ethanol toxicity, people who have a cerebellar or hippocampal vulnerability may experience oxidative DNA damage from ethanol. Natural antioxidants that help shield the brain include procyanidins found in grape seeds. [37]

Punica Granatum (Pomegranate)

A member of the Lythraceae family's Punicoideae subfamily, the pomegranate (*Punica granatum*) is a deciduous shrub that offers fruit. 5 to 10 meters (16 to 33 feet) is the range of its height. Held a potent antioxidant inside, more total phenolic content and antioxidant activity can be found in the peel of pomegranates than in the pulp. [38] Fruit that have been farmed in western Asia and other parts of the Mediterranean and beyond since ancient times. Reaching a height of 5–8 meters (16–26 feet), the Pomegranate is a sturdy deciduous shrub or tree. *Punica* is the Roman term for the pomegranate, which was first used in Carthage. Pomegranates, or officially seeded apples (*granatus*) (*pomum*), are referred to as grenade in French and Granada in Spanish. Pomegranate seeds have several nutritional benefits and have a high dietary fibre content (20% DV). A plethora of human trials and study inquiries have examined the protective properties of pomegranates against several health-improving illnesses, including antioxidant, antibacterial, and anti-inflammatory properties. [39]

Aloe Barbadensis (Aloe Vera)

In botany, the plant is known as *Aloe barbadensis* miller. It belongs to the Asphodelaceae (Liliaceae) family and is a perennial, shrubby or arborescent, xerophytic, succulent, pea-green plant. *Aloe barbadensis* Miller is the plant's scientific name. Antioxidants include polyphenols, indoles, and alkaloids. Natural sources include tocopherols, flavanoids, and gallic acid esters.

Peroxide decomposers including glutathione peroxidase, metal chelators, methionine, and thioethers are examples of secondary antioxidants. ^[40,41] Aloe vera is rich in biochemicals, including lectins, fatty acids, terpenoids, flavonoids, anthraquinones, tannins, salicylic acid, and carbohydrates (hemicelluloses, pectin's, and glucomannan). Vitamins A, E, C, B1, B2, B3, B6, and B12, as well as minerals including zinc, manganese, magnesium, phosphorus, potassium, calcium, iron, copper, manganese, sodium, and β -carotene, are also abundant in this plant. Reaping the plant three years after it grows is the greatest option since it has the maximum quantity of flavonoids (4.70 g/kg) and polysaccharides (6.55 g/kg). Additionally, aloe vera has been shown to offer significant skin protection against gamma and UV radiation. ^[42]

Matricaria chamomilla(Chamomile)

The annual plant *Matricaria chamomilla* (synonym: *Matricaria recutita*), often known as German chamomile, Hungarian chamomile (kamilla), wild chamomile, blue chamomile, and fragrant may weed, is a member of the composite family Asteraceae. *M. recutita* is the popular name for the herbal product chamomile, though it can also refer to other species. It is a common plant to make tea from dubbed the "star among medicinal species," is a well-known species of herb. Now a days, this herb is highly prized and frequently utilized in conventional and folk medicine. Flavonoid and antioxidant: Apigenin. Up to 0.6% of germacranolide-type sesquiterpene lactones, namely nobilin and 3-epinobilin, are found in chamomile. Bisabolol oxides A and B, α -bisabolol, farnesene, and chamazulene or azulenesse. ^[43,44] Chamomile contained properties that were analgesic, immune-stimulating, anti-inflammatory, anti-bloating, antioxidant, and cholesterol-lowering, gastrointestinal disorders, headaches, and reduces menstrual pain and stimulation. Lipid peroxidation is prevented by chamomile and azulene essences via inhibition of lactate dehydrogenase (LDH) oxidation. Frenesene, chamomzolin, bisabolol, coumarins, and flavonoids are the principal constituents of chamomile. Because they contain free quercetin and adrenaline, this plant's flowers are used in traditional medicine to alleviate stomach problems. Ardakani and colleagues state that the phenolic components in chamomile act as antioxidants, stop superoxide anion radicals from breaking down collagen, and this medicinal herb possesses antimicrobial, anti-diarrhea, anti-cancer, and neuroprotective qualities. Some preclinical studies show that it inhibits the growth of malignant ovarian and skin cells via inducing apoptosis in malignant cells. Furthermore, chamomile essential oil contains α -bisabolol, another terpenoid. ^[45]

Olea Europaea (Olives)

The olive, formally known as *Olea europaea*, or "European olive," is a kind of small tree or shrub that belongs to the Oleaceae family and is mainly found in the Mediterranean region. While in shrub form, 'Montra', tiny olive, or little olive. Table olives contain a variety of phenolic compounds, including simple phenols (phenolic alcohols and acids); secoiridoids (oleuropein, demethyl oleuropein, ligstroside, and derivatives such as 3, 4-DHPEA-EDA and p-HPEA-EDA); derivatives of hydroxycinnamic acid (verbascoside and iso-verbascoside); lignans; and flavonoids. ^[46] Olive leaf is an additional medicinal herb with antioxidant properties. Many products and leaves from the olive tree have been used historically in traditional medicine, particularly in the Mediterranean region, to treat and prevent a wide range of ailments. Bioactive compounds that may decrease cholesterol and have hypoglycemic effects are abundant in these leaves. Safety even at high dosages is demonstrated by toxicity studies. Olive leaves contain the highest concentration of phenolic compounds of any part of the tree; the main phenol-rich material in the leaves is oleuropein. Olive leaves include bioactive compounds that are known to possess antioxidant properties, including tyrosol, ligstroside, hydroxytyrosol, and caffeic acid. These chemicals, belonging to the secoiridoid group, are bioactive because of their primary phenolic component. Because extra virgin olive oil has a chemical composition that includes polyunsaturated fatty acids, carotenoids, flavonoids, α -tocopherol, and other phenolic compounds, as well as an unsaponifiable fraction, the amount of this oil is growing. Oleuropein and ligstroside are the two primary polar glycosides found in olives. Many studies suggested that olive oils have a protective effect because they are the main sources of antioxidants. Polyphenols found in olive oil help shield blood lipids from oxidative damage. Furthermore, the primary phenol found in olive oil, oleacein, has anti-inflammatory properties, protective qualities against oxidative stress and atherosclerosis, and favourable effects on cardiovascular disease. The biological benefits of olives and virgin olive oil include anti-inflammatory, neuroprotective, endothelial, and cardiovascular disease prevention. ^[47]

Origanum Vulgare (Oregano)

Oregano (*Origanum vulgare*) is a species of flowering plant in the Lamiaceae family. It is prized for both its dried leaves and fragrant flowering tops. It originated in the Mediterranean region and has spread far throughout the temperate Northern Hemisphere. Carvacrol and thymol concentrations in the essential oils are the main factors influencing oregano oil's antioxidant properties. ^[48] Cultivated for centuries in the Mediterranean region, oregano has several antioxidant properties that have been shown in extracts and individual constituents. These properties can help relieve inflammatory diseases, digestive and respiratory issues, headaches, rheumatism, and diabetes. One of the most potent antibacterial and antioxidant agents is oregano essential oil (OEO), which has antioxidant qualities that effectively delay lipid peroxidation in fatty diets and can scavenge free radicals. ^[49]

Cynara Scolymus L (Artichoke)

Cynara scolymus L., the perennial artichoke, belongs to the Asteraceae family. Globe artichoke *Cynara cardunculus*, (Scolymus Group) are upright, columnar perennial vegetables with thistle-like blooms and lobed, jagged, deeply serrate green leaves (Daisy family). The most likely ancestor of the Scolymus Group is Cardoon (*Cynara cardunculus*). Incorporate the flavones, hydroxycinnamic acids, and vitamin C, an antioxidant. Within this vegetable, and consequently in its waste, the main phenolic compounds are flavonoids and hydroxycinnamic acids. ^[50,51] *Cynara scolymus*, sometimes known as artichoke leaf extract (ALE), was one of the few herbal medicines that showed promise in both clinical and experimental trials. Bioactive and flavonoid substances including luteolin glucosides and caffeoylquinic acids are found in ALE. It is also known that this herb has strong antioxidant, choleric, hepatoprotective, bile-enhancing, and lipid-lowering properties. Research has shown that artichokes appear to have a hepatoprotective effect. Its long-standing use in treating bowel and digestive issues in people has been researched. It lowers cholesterol, which helps to prevent heart disease. Furthermore, cooked wild artichokes were shown to have no effect on individuals with metabolic syndrome but to reduce postprandial hyperglycemia and insulinemic responses in normal people. According to reports, the chemical makeup of artichoke heads and leaves is rich in minerals, fibre, inulin, and

polyphenolic substances. In addition to its inhibitory effects on LDL oxidation and cholesterol biosynthesis, ALE has demonstrated antioxidative, antibacterial, anti-HIV, bile-expelling, hepatoprotective, urinate, and choleretic capabilities.^[52]

Momordica Charantia (Bitter Melon)

A tropical and subtropical vine belonging to the Cucurbitaceae family, *Momordica charantia* is widely grown in Asia, Africa, and the Caribbean for its tasty fruit. Numerous other names for it exist as well, some of which are listed below: balsam-pear, Goya, Kara Vila, bitter melon, bitter apple, bitter gourd, and many more. The bitterness and shape of its many varieties differ significantly.^[53] Bitter melon is rich in antioxidants, including carotenoids (carotene, xanthophylls, and zeaxanthin), water-soluble vitamin C, and lipophilic vitamin E there are two varieties of bitter melon fruits, each with unique hues and forms. The most complete variant is the yellow one with a spindle-shaped appearance. Ripe fruits have less flavonoid concentration than immature fruits. Stearic acid, oleic acid, fatty acids, and a group of B vitamins are abundant in this plant. Alkaloids, glycosides, and ascorbic acid are plentiful in the bitter melon. The Indian subcontinent's traditional medicine has long treated diabetes and jaundice with the leaves and fruits of this plant.^[54]

Rumex Acetosa (Sorrel)

The Polygonaceae family includes the perennial herbaceous plant known as sorrel (*Rumex acetosa*), also referred to as garden or common sorrel. Other names for sorrel include spinach dock and narrow-leaved dock (the term "dock" is a common name for the genus *Rumex*). Sage is a widespread plant in grassland areas and is native to Eurasia. It's commonly grown as a leafy vegetable or herb.^[55] As *Acetosella Vulgaris*, the sorrel species commonly referred to as sheep's sorrel (*Rumex*) demonstrates enduring anti-proliferative, antioxidant, antiviral, anti-mutagenic, and anti-genotoxic properties. Historically, traditional medicine has employed its roots and other parts to cure a wide range of illnesses, such as gallbladder and liver ailments, scurvy, constipation, diabetes, infections, diarrhoea, jaundice, and edoema. Researchers discovered that certain plant sections have biologically active phytochemicals that have analgesic, diuretic, antibacterial, antioxidant, and anti-inflammatory properties. The antioxidant properties of rosemary and Japanese green tea are nearly identical. The flowers and rhizomes of rosemary contain bioactive substances that have anticancer effects. This plant has antioxidant-rich polyphenols and flavonoids in its aerial parts, and it has antitumor-potent polysaccharides and anthraquinones in its rhizomes. This plant also contains naphthalenes, emodin, triterpenoids, stilbenoids, tannins, carotenoids, geranin, corilagin, vanillic acid, sinapic acid, gallic acid, and pyrogallol, among other biochemicals.^[56]

Berry

A berry-bearing plant is called baccate or bacciferous. Pepos are long, hard-skinned fruits in the Cucurbitaceae family, which also includes cucumbers, gourds, and watermelons. Generally speaking, berries are any tiny, fleshy fruit, especially one that is edible.^[57] One of the strongest naturally occurring antioxidants is thought to be anthocyanin. Berries, have been found to possess antioxidant and chemopreventive qualities. Adequate fruit consumption lowers the risk of major chronic illnesses such as obesity, cardiovascular problems, type 2 diabetes mellitus, and cancer. Anthocyanidins, a type of flavonoid found in berries, have the ability to penetrate the blood-brain barrier and accumulate in areas related to learning and memory, including the hippocampus. Raspberries include anthocyanin colours, quercetin, gallic acid, ellagic acid (from ellagitannins, such as the polyphenol ellagitannin), cyanidin, pelargonidin, catechins, kaempferol, and salicylic acid. The components of berries can protect against ROS damage, especially when it comes to the advancement of neurological conditions like Alzheimer's. Demonstrated that of the anthocyanins studied, cyanidin 3-glucoside had the most antioxidant activity. A few species of *Rubus*, as well as hybrids between *Idaeobatus* and *Rubus* subgenera, produce the edible blackberry fruit. These fruits are high in dietary fibres, vitamins C and K. This fruit has 7.6 grammes of fibre and 144 grammes, or half of the daily required intake of vitamin C, in just one cup. The high anthocyanin and polyphenol content in black and red berries contributes to their health-promoting properties.^[58]

Marrubium Vulgare (White Horehound)

A blooming plant native to Europe, northern Africa, and southwestern and central Asia is called *Marrubium vulgare*, sometimes referred to as common or white horehound and belonged to the Lamiaceae family. The majority of North and South America have also seen widespread naturalization of it.^[59] The antioxidant and antibacterial properties of antioxidant malic acid (tms) have been reported earlier in relation to *M. vulgare*.^[60, 61] According to studies, *M. vulgare* possesses exceptional antioxidant activity and can be utilised to treat liver disorders, diabetes, and cancers due to its sedative, anti-inflammatory, hypotensive, and lipid-lowering properties. Additionally, it possesses antibacterial qualities against fungi, herpes simplex virus, gram-positive bacteria, and parasites such *Plasmodium berghei*, *Toxoplasma gondii*, and *Trichomonas vaginalis*. Though there have been trends towards its production, further research is required to determine the practical use of this plant and its preparations.^[62]

Citrus:

With grey leaves, this herbaceous perennial plant grows to a height of 25–45 cm (10–18 inches). The leaves measure 2.5–5 cm (0.8–2.0 inches) in length and are coated in fluffy hairs. Their surface has a lot of wrinkles. Clusters of white blossoms adorn the upper part of the main stalk. All citrus fruits belong to the Rutaceae family. Members of this family, usually known as the rue family, are typically aromatic blooming plants. Grape fruits, oranges, limes, and lemons are examples of citrus fruits. The combination action of limonoids and flavonoids was related to the antioxidant effects.^[63] Flavonoids include hesperidin and naringin are found in citrus fruits. Approximately 75% of all farmed citrus fruits are oranges, one of the most well-known citrus fruits. The Queen Orange (*Citrus sinensis*), a red fruit in the middle of the season, is widely grown in Iran. It grows on trees, has a strong flavour, dissolved solids, and, inexplicably, no seeds. The orange trees are robust, incredibly abundant, and cold-hardy. 100 grammes of orange pulp provides the body with 64% of the daily required intake of vitamin C. numerous phytochemicals, including carotenoids (beta-carotene, lutein, and beta-cryptoxanthin), flavonoids (naringenin), and volatile organic compounds (aldehydes, esters, terpenes, alcohols, and ketones) are included in orange. The antioxidant potential of six different varieties of orange juices (OJs) was evaluated using a cellular model (*Saccharomyces cerevisiae*) and chemical techniques, including total phenols by Folin-Ciocalteu assay in the hydrophilic fraction (phenolic compounds and ascorbic acid), Trolox equivalent antioxidant capacity (TEAC), and ferric reducing activity/antioxidant power (FRAP).^[64] The ascorbic acid-rich orange and yellow

fruits and vegetables, such as grapefruit, mango, yellow pepper, orange, banana, pear, nectarine, and pineapple, have also been found to have a higher antioxidant capacity than fruits and vegetables.

Juglans genus (Walnut)

The edible seeds of any tree in the *Juglans* genus belong to the Juglandaceae family, particularly *Juglans regia*, the Persian or English walnut, are known as walnuts. Polyunsaturated fatty acids (PUFAs), tocopherols, phytosterols (stigma sterol, campesterol, and sitosterol), antioxidant polyphenols (catechins, resveratrol, and ellagitannins), and active prebiotics are all abundant in walnuts. [65] Walnuts also include additional substances such as sterols, dietary fibre, protein, melatonin. [66, 67, 68] More antioxidants and omega-3 fats than most other foods can be found in walnuts. Consuming walnuts can help protect the brain and lower the risk of cancer and heart disease. Walnuts are low in carbohydrates and comprise roughly 15% protein and 65% fat. Additionally, that they contain a comparatively high amount of the beneficial omega-3 fat alpha-linolenic acid (ALA). [69] This accounts for around 8–14% of the overall fat content. Regarding walnuts, a recent meta-analysis of 24 RCTs found a substantial continuous dosage response connection between walnut intake and a reduction in blood cholesterol.

Kiwi Fruit

Members of the Actinidiaceae family include kiwifruit. Despite having Asian origins, it is enjoyed widely all over the world. It was initially introduced to New Zealand, where the fruit industry greatly benefits from it. Over the past 20 years, kiwifruit consumption has increased significantly in western nations. Including the antioxidants ascorbate and phenolic compounds. Actinidia, a genus of woody vines, produces the edible berry known as kiwi fruit, often called Chinese gooseberry (sometimes shortened to "kiwi" outside of New Zealand). The most common cultivar group of kiwi fruits, *Actinidia deliciosa* 'Hayward,' is oval in shape and roughly the size of a big hen's egg, measuring 4.5–5.5 cm (1+3/4–2+1/4 inches) in diameter and 5–8 cm (2–3 inches) in length. [70] Kiwi fruit its high vitamin C content and powerful antioxidants, which include lutein, carotenoids, flavonoids, phenolics, and chlorophyll, kiwi fruit is an extremely nutrient-dense fruit. Rich in fructose, galactose, and minerals, kiwi fruit also includes flavones and flavonoids, which are significant phytochemicals in kiwi extract. [71] Phytoestrogen, which has significant anticarcinogenic, neuroprotective, and cardiovascular protective properties. In ancient China, kiwi fruits were used as a therapy for several cancers, to boost complete spontaneous bowel motion, improve transit time, and enhance rectal feeling, as well as to relieve the symptoms of many ailments like rheumatism, dyspepsia, haemorrhoids, and digestive issues.

Prunus Dulcis (Almonds)

Prunus dulcis is a little tree belonging to the Rosaceae family. The edible, widely farmed "nut" of this tree is also called an almond. Iran is surrounding areas are the natural home of almonds, which may also be grown in Mediterranean environments. Encased in an exterior hull, the seed or nut of the almond fruit is located inside its hard shell. The process of shelling an almond involves removing the seed from its shell. Almonds are offered for sale with or without shells. [72] Flavonoids, sterols, and vitamin E are all found in abundance in almonds and have all been linked to potential health benefits. Almonds are a highly sought-after tree nut globally and a prime provider of vitamin E. Rich in antioxidants, vitamins, minerals, and good fats, they are extremely nutrient-dense. Heart disease, cancer, and Alzheimer's disease are all reduced. According to a study, consuming 42 grammes of almonds a day reduced LDL cholesterol by 5.3 mg/dL while keeping "good" HDL cholesterol same. [73]

Avocado

A common occurrence in tropical or subtropical regions is the avocado tree. In addition to the genus *Persea*, this has just two species, *P. Americana* and *P. cerulean*, belonged the Lauraceae family is divided into three subgenera, which collectively have approximately 150 species. There is an antioxidant called beta carotene. As before, it was prized for its huge, incredibly fatty fruits. It is most likely the tree that originated in the hills that connect Guatemala and south-central Mexico. [74] Avocados are high antioxidant content, and distinct biochemical profile. As a different kind of dietary supplement, avocado oils are utilised to treat osteoarthritis. [75] In avocados have been traditionally used to cure a variety of illnesses and problems because they have various health benefits, including its oil. Additionally, the unique impact of avocado β -sitosterol on immunology helps treat diseases including cancer and HIV 124 infections. If two grammes of these substances are consumed daily, the risk of coronary heart disease is reduced by 25%. Some phytochemicals that have been identified include Apigenin, luteolin, rutin, quercetin, and orhamnetin.

Moringa Oleifera (Moringa)

The drought-resistant, quickly-growing *Moringa oleifera* tree, which is widely used in South and Southeast Asia, is native to the Indian subcontinent. It belongs to the Moringaceae family. Common names include malunggay (known in maritime or archipelagic areas of Asia), drumstick tree (from the tall, thin, triangular seedpods), horseradish tree (from the flavor of the roots, which mimics horseradish), and Moringa. [76] Moringa is an antioxidant that contains glutathione, vitamins C, A, and E, as well as enzymes like superoxide dismutase, catalase, and other peroxides. One of the best foods for boosting immunity and preventing or treating about 300 ailments is drumstick. It might be regarded as a super food as well. The plant's parts are all utilised to treat various illnesses. It is a commercial crop that farmers plant in order to profit greatly from its appeal on both the domestic and global markets. It is a crop that is environmentally beneficial and can be used in sustainable farming. The indigenous medical system uses different sections of this plant to cure different diseases. The leaves are a great source of protein, folic acid, pyridoxine, nicotinic acid, UFAs (alpha linoleic acid), vitamins (A, B, C, and D), and minerals (calcium, iron, and sulphur). [77]

Mangifera Indica (Mango)

The member of Anacardiaceae family of flowering plants, mangoes are found in the genus *Mangifera*, which comprises roughly thirty species of tropical fruiting trees. Edible stone fruits, mangos are produced by the tropical tree *Mangifera indica*. It came from the region that is now Bangladesh, northeastern India, and northwest Myanmar. Following the initial cultivation of *M. indica* thousands of years ago in South and Southeast Asia, modern mango cultivars are classified as "Indian type" or "Southeast Asian type." Several species that are also found in the Malesian Eco region generate the majority of the edible fruits that are referred to as "mangoes". In Mango fruits are rich in dietary antioxidants called polyphenols, which include flavonoids, xanthones, and phenolic acids. [78] The antioxidants beta-carotene and vitamin C, which are abundant in mangoes, have anti-aging properties,

improve digestion, preserve eye health, and boost immunity. A rich source of vitamin A is mango, which promotes healthy hair development and the production of sebum, a lubricant that lubricates the scalp. Mangos supply 10% of your daily requirement for vitamin A in just one cup (165 grams). Because it aids in the battle against infections, vitamin A is necessary for a robust immune system.^[79] Mango polyphenols may combat oxidative stress, which has been connected to malignancies of the breast, colon, lung, prostate, and bone.

Apium (Carrot)

The member of Apiaceae family, commonly referred to as Umbelliferae and named after the parent genus *Apium*, is mainly composed of aromatic blooming plants, such as celery and carrots. Carrots (*Daucus carota* subsp. *sativus*) are orange-colored root vegetables that contain antioxidant polyphenols such as (flavonoids, xanthenes, and phenolic acids). Heritage cultivars of *Daucus carota*, a wild plant native to Europe and Southwestern Asia, are available in purple, black, red, white, and yellow varieties. In Orange and purple carrots both contain beta-carotene.^[80] One dietary source rich in nutrients are carrots. Lycopene, which decreases the risk of heart disease, is also present in red carrots. Retinal degeneration can result in visual impairments and is one of the causes of vitamin A insufficiency. The most provitamin A compound found in carrots, β -carotene, protects against macular degeneration and the development of senile cataracts, the main cause of blindness in the elderly. It also helps to preserve eyesight, particularly at night. Carrots are healthy for your eyes, and eating them high in β -carotene may help restore vision.^[81] One of the best foods for provitamin A is carrots, and eating a lot of carotenoids has been associated with a considerable reduction in postmenopausal breast cancer. Studies have additionally demonstrated that individuals who smoke and consume carrots more frequently have a decreased risk of lung cancer. Additionally, a diet high in beta-carotene may offer protection against prostate cancer.

Spinacia Oleracea (Spinach)

Leafy green, flowering plants with green foliage are native to Central and Western Asia (*Spinacia oleracea*). It is a member of the Caryophyllales order, subfamily Chenopodioideae of the Amaranthaceae family. Popular edible vegetable leaves can be dehydrated, frozen, or canned, and are also edible raw. While steaming can reduce its high oxalate content, it tastes quite different whether eaten raw or cooked. In coumaric acid, ferulic acid, lutein, and beta carotene, Vitamin A, ascorbic acid, and a variety of minerals are just a few of the many vital components that have been shown to be present in spinach. Though many researches have been done on spinach's antioxidant properties.^[82] A highly healthy and essential vegetable that may be consumed either fresh or cooked is spinach. Rich in iron, it can help avoid some disorders including osteoporosis and anemia caused by iron deficiency. Iron can be found in a variety of food types, including raw, tinned, boiled, pureed, frozen, dried, cooked, and baked foods. For the digestive system, spinach is more beneficial. One pint of raw spinach juice per day will help.^[83] Additionally useful for treating and preventing dental cavities, spinach juice also strengthens gums. When treating bronchitis, TB, asthma, and dry cough, an infusion of fresh spinach leaves made with two teaspoons of fenugreek seeds combined with honey works well as an expectorant.

Apiumgraveolens (Celery)

Celery (*Apiumgraveolens*), a wetland plant is belong to the Apiaceae family, as a vegetable. The long, rigid stalk of celery in to the leaves. Its stalks, leaves, or hypocotyls are edible and can be cooked, depending on the cultivar and region. One spice that's used is celery seed powder. Apigenin was the main flavonoid in this sample, and the most abundant phenolic acid was p-coumaric acid. Studied plants had high levels of phenolic compounds and antioxidant capacity.^[84] Along with a unique therapeutic plant, it has an alimentary herb. Drinks like cocktails can be enhanced with the flavor of celery leaves. Minerals including iron, calcium, phosphorus, magnesium, and zinc are included, along with vitamins A, B1, B2, B6, C, E, K, and P. Celery's vitamin C boosts immunity while also increasing the body's resistance to newly discovered illnesses.^[85] In the juice taken out of the petiole's edema, gout, rheumatoid arthritis, flatulence, persistent pulmonary catarrh, as well as tendencies toward obesity and appetite loss. Its use as a urinary antiseptic and potent diuretic are mostly due to the volatile oil Apiole. When consumed raw or cooked into tea, celery can help alleviate skin conditions. A sedative and bronchitis remedy made from celery seeds is also employed. Impaired sexual arousal can be restored with oil derived from the root.

Brassica Oleracea (Kale)

Three different cultivars of celery (*Apium graveolens* L.) belong to the Apiaceae (Umbelliferae) family. Kale, sometimes known as leaf cabbage, is a cultivar of cabbage (*Brassica oleracea*) mostly grown for their edible leaves. Furthermore, it has been used as a decorative plant. Proven to be abundant in phenolic acids (ferulic acid, sinapic acid, salicylic acid).^[86] Strong antioxidants like kaempferol and quercetin make kale a great choice for heart health and cholesterol reduction, especially when steamed. Kale is rich in lutein and zeaxanthin, and vitamin K is a crucial ingredient that aids in blood clotting. All of these nutrients work together to give your body protection and support against various ailments, such as heart disease, osteoporosis, and arthritis. They also support healthy cell growth, a functioning metabolism, and the removal of dangerous poisons from your body.^[87]

Allium Cepa L (Onion)

As perennial, bulbous, and herbaceous plants, most flowering plants in the Amaryllidaceae family belong to the monocot order Asparagales. The most widely farmed species in the *Allium* genus is *Allium cepa* L., whose name means "onion" in Latin. It goes by the name's common onion and bulb onion occasionally. Only in 2011 was the shallot, a botanical variety of the onion, identified as a separate species. Its near cousins include the chive, garlic, shallot and leek.^[88] Flavonoids antioxidants found in onions. Quercetin, which is abundant in onions, has several health benefits for people, including anti-oxidant, anti-inflammatory, antiviral, cardiovascular, and anti-cancer effects. Onions may reduce the incidence of stomach, lung, oesophageal, and brain cancer. It has been found that eating fruits and vegetables adds between 15 and 40 mg of quercetin to the diet per day on average.^[89] In addition to promoting the healing of stomach ulcers and preventing the growth of cultured ovarian, breast, and colon cancer cells, quercetin and kaempferol have been shown to help prevent the development of cancer tumors.

Orange Juice

Oranges are fruits of many citrus species belong to the Rutaceae family consist of potent antioxidant, the term is mainly used to refer to *Citrus sinensis*, commonly known as sweet orange, to differentiate it from the related *Citrus aurantium*, generally known as bitter orange. ^[90] Hesperidin, a flavanone glycoside, is found in orange juice. In the realm of fruits, the sweet orange holds significant economic value. Antioxidants derived primarily from oranges, both whole and juiced, are beneficial for the body's absorption as numerous studies have demonstrated. Consuming 480 mL of orange juice per day resulted in reductions of 11% in total cholesterol, 18% in LDL cholesterol, 12% in Apo lipoprotein B, and 12% in the LDL/HDL ratio when compared to non-consumers. ^[91]

Grapes

The belonged to Vitaceae family. A grape, or berry technically, is a fruit of the woody, deciduous vines in the genus *Vitis* of flowering plants. Grapes are an example of non-climacteric fruit; they are usually seen in bunches. The main hydroxycinnamic acids are ferulic acid, caffeic acid, chlorogenic acid, coumaric acid, sinapic acid, and gentisic acid also including hydroxybenzoic acids in grapes are vanillic acid, syringic acid, gentisic acid, ellagic acid, and protocatechuic acid. ^[92] One of the earliest crops associated with human history during the evolution of mankind is the grape. Grapes are commonly known to contain the flavonols epicatechin and catechin. Studies on epidemiology showed that consuming red wine derived from grape juice in moderation can slow down the onset of neurodegenerative diseases. In muscadine grapes, resveratrol is also present in the seeds, but it is mostly generated in the berry skins of grapevines, where it is naturally occurring. Red grapes have a larger concentration of this chemical than white grapes. Within 100 grams of red grapes, the total resveratrol content ranges from 0.15 mg to 0.78 mg. Fresh grape skins are thought to have 50–100 µg of resveratrol per gram of wet weight. It is possible to treat neurological disorders, Alzheimer's, Parkinson's, and Huntington's diseases, as well as prolong life and have anti-aging effects by using resveratrol. One of the most potent antioxidants found in grapes, "melatonin," is engaged in a number of bodily physiological processes. ^[93]

Blueberries

The belonged to Ericaceae family. Blueberries are a wide variety of blue- or purple-berry-bearing perennial flowering plants. They belong to the section *Cyanococcus* within the genus *Vaccinium*. There are also huckleberries, Madeira blueberries, cranberries, and bilberries in the vaccine. Commercial blueberries, both wild (low bush) and grown (high bush), originated in North America. Europeans first saw the high bush variety in the 1930s. Known to be the strongest antioxidants found in nature, anthocyanins have shown to have many other uses besides just scavenging free radicals. ^[94] A high concentration of phytochemicals called anthocyanins, which have potent antioxidant properties, is what gives the color its deep blue-purple hue. A weekly intake of 150 g of blueberries has been linked in studies to a possible reduction in blood pressure. Additionally, studies have suggested that the presence of flavones, phenolic compounds, and tannins in blueberries may have a protective effect against colon cancer and other cancers. Particular research has indicated that the flavonoids luteolin and kaempferol may have an inhibitory effect on the growth of ovarian cancer. ^[95]

Punica Granatum (Pomegranate)

The belonged to Lythraceae family's Punicoideae subfamily, the pomegranate (*Punica granatum*) is a deciduous shrub that offers fruit. 5 to 10 metres (16 to 33 feet) is the range of its height. Methionine, valine, and proline are antioxidants. Polyphenols are abundant in the peel and juice. Because of their peculiar antioxidative and preservation properties, tannins and flavonoids the major classes indicate the medicinal potential of pomegranates. ^[96] Scientists view pomegranates as super foods because, although they are a popular eating fruit, numerous research conducted in recent years have suggested that they may have positive impacts on health promotion and advocacy from a variety of pathology problems. A pomegranate's high concentration of bioactive elements, such as vitamins, ellagitannins, polyphenols, and phenolic compounds, is directly linked to its vital characteristics. Significant anti-inflammatory and antioxidant qualities of many of these phytochemicals have been demonstrated to improve human health. ^[97] Around half of the juice's potent antioxidant action comes from punicalagin, the most significant pomegranate polyphenol. In based on research findings, those with high-risk characteristics of atherosclerotic and cardiovascular diseases.

Cranberry

In this widely distributed family of plants, Ericaceae, which is well-known for its heath. Cranberries are evergreen dwarf shrubs or trailing vines that belong to the subgenus *Oxycoccus* of the genus *Vaccinium*. In North America, *Vaccinium macrocarpon* is the native species known as cranberry, but in Britain it is known as *Vaccinium Oxycoccus*. In among the few fruits that are rich in Proanthocyanidins, antioxidant anthocyanins, and quercetin are present which prevent *Escherichia coli* from adhering to the urinary tract cranberries are one of the best. ^[98] Cranberries are a great source of antioxidants, particularly phenolic compounds. They are especially high in Proanthocyanidins, ellagic acid, flavonoids such flavonols, quercetin, and myricetin, and flavonoids like flavonols. They may offer robust defence against free radical damage. Drinking cranberry juice raises HDL cholesterol while lowering LDL cholesterol. Reduced the prevalence of urinary tract infections overall as well. ^[99]

Malus Domestica (Apple)

Apple trees (*Malus spp*, notably *Malus domestica*, the domestic or orchard apple) provide round, edible fruits that are called apples. Apple trees are cultivated worldwide, being the most widely cultivated species in the genus *Malus*. In Central Asia, where the tree first appeared, *Malus sieversii*, its wild parent, is still alive. Apples have been farmed for millennia in Asia and Europe. Apples were introduced to North America by European settlers. Pomoideae and Rosaceae subfamily Pumila are families. The most popular fruit, apples (*Malus domestica*), are rich in bioactive substances such pectins, dietary fibres, vitamins, oligosaccharides, triterpenic acids, and phenolic substances like flavonols and dihydrochalcones. ^[100, 101] In vitro colon and liver cancer cell growth is suppressed in a dose-dependent manner by apple extracts, and 100 g of thoroughly cleaned apples show antioxidant capacity equivalent to 1500 mg of vitamin C. Red Delicious apples were extracted with 80% acetone to evaluate the number of flavonoids and phenolic present. The fresh apple extracts had 142.7 ± 3.7 mg and 97.6 ± 3.9 mg of flavonoids and 290.2 ± 4.2 mg and 219.8 ± 1.8 mg of phenolic compounds per 100 g of apples. Across all tested dosages, the apple extracts exhibited negligible cytotoxicity. ^[102]

Caryopsis (Grain)

A grain is a small, hard, dry fruit (*caryopsis*) that is harvested, either with or without a shell coating, for use as food by people or animals. Grain crops are those that produce grains. The two main types of commercial grain crops are legume and cereal crops. Belonged to the Poaceae family, local term: *cereals* the scientific name is *caryopsis*. Generally classified as phenolic acids, flavonoids, stilbenes, coumarines, and tannins, phenolic chemicals are the most prevalent antioxidants found in whole grains. ^[103] Phytochemicals found in grains include antioxidants and hormone mediators, two of the many ways they promote human health. Numerous studies have established the protective effects of whole grains against colon cancer, breast cancer, diabetes, coronary heart disease, and overall mortality. Grain-based lignans and phytoestrogens may reduce the risk of several hormone-related diseases, such as breast and prostate cancer. ^[104]

Carya Illinoensis (Pecan Nut)

Native to the southern United States and northern Mexico along the Mississippi River, the pecan, also called *Carya illinoensis*, is a hickory species. Belonged to the Juglandaceae family the primary growing regions for the tree's seeds are Georgia, Texas, and Mexico. About 90–150 mg/g of dried peanut skin contains a variety of rich polyphenolic components, including flavonoids, phenolic acids, procyanidins, and anthocyanins. The pecan's antioxidant qualities. ^[105] Pecan nuts have low quantities of saturated fatty acids and high amounts of monounsaturated and polyunsaturated fatty acids. The presence of bioactive chemicals such as sterols and tocopherols, as well as a significant quantity of phenolic compounds comprising gallic acid, ellagic acid, protocatechuic, p-hydroxybenzoic, and catechin with possible natural antioxidant activity, was also discovered. Pecan nuts have a high fibre content ($48\% \pm 0.06$), and a total phenolic content (116–167 mg GAE/g) and condensed tannin content (35–48 mg CE/g) range. The percentage range of oxidation inhibition in the β -carotene, linoleic acid combination is between 70% and 96%. The results showed a considerable phenolic content and high antioxidant activity in the pecan nutshell infusion. ^[106]

Coffea Arabica (Coffee Brews)

Coffee is bitter, tastes black, and has a tiny acidity. Its high caffeine content makes people feel energised. *Coffea arabica* is its scientific name. A member of the Rubiaceae family. The presence of n-coumaric, caffeic, ferulic, and chlorogenic acids in coffee is linked to its antioxidant properties. ^[107] Brown pigments called melanoidins, which are produced in roasted coffee, are potent antioxidant. Certain sources also classify trigonelline and caffeine as antioxidants. ^[108] Studies utilizing a variety of detection techniques have been conducted on coffee beans and coffee beverages. Recent studies have shown that coffee's powerful antioxidant qualities are largely due to the polyphenols included in the beverage. The readings of 2, 2, 6, 6-tetramethyl-1-piperidin-1-oxyl (TEMPO) or Fremy's salt (potassium nitrosodisulfonate) may vary considerably depending on whether stabilized radical is used. When assessing the antioxidant activity of coffee's Maillard reaction products, the radical marker (TEMPO) seems to be the best option. Because of this, both polyphenols and melanoidins, which are important antioxidant active chemicals, may be important, especially in the ratio that varies based on roasting circumstances. Tests conducted during storage have revealed that certain variations in antioxidant activity in coffee brews are time-dependent. ^[109]

Fragaria Ananassa (Strawberries)

The belonged to Rosaceae family includes the popular hybrid variety of strawberries, or garden strawberries (*Fragaria ananassa*), which are grown for its fruit all over the world. The fruit's unique aroma, bright red colour, juicy texture, and sweetness make it popular. It is eaten in large quantities, either unprocessed or processed into pies, ice cream, milkshakes, chocolates, jam, and juice. Certain chemicals found in strawberries, such quercetin and ellagic acid, when they are purified or fractionated and occasionally enhanced with particular components. ^[110] The consumption of strawberries (Frag aria ananassa), both fresh and processed, is widespread and thus provides a significant source of various compounds with significant health benefits against different diseases, such as phenolic compounds with their antioxidative and antiproliferative properties. Strawberry extracts and their components have been shown to have anti-cancer, anti-inflammatory, and heart disease prevention characteristics due to reduced oxidation of low-density lipoprotein and platelet aggregation. ^[111]

Grape Juice

A grape is a fruit, technically a berry, of the flowering plant genus *Vitis*, which includes deciduous woody vines. Unclimacteric fruit, grapes are usually seen in bunches. Since grapes were first cultivated more than 8,000 years ago, people have eaten the fruit. Around the world, grapes are eaten either fresh or dried (as sultanas, currants, and raisins). Among the additional products made from grapes are numerous types of jam, juice, vinegar, and oil. Belonged to the Vitaceae family: *Vitis rotundifolia* Michx, *Vitis labrusca* L. Because they contain a variety of phytochemicals, including resveratrol, epicatechin, anthocyanin, and Proanthocyanidins, grapes are a good natural source of antioxidants. ^[112] Grapes, particularly red grapes, are rich in phenolic compounds. In addition to their role in the creation of grape products, phenolic chemicals are being researched for potential health advantages. They can shield cells from oxidative damage and contain a variety of antioxidant qualities. High in polyphenols has been shown to lower the risk of cancer and cardiovascular disease. In another study, the DPPH method was used to assess the antioxidant efficacy of red wine in 16 samples. The findings ranged from 6.10 to 17.41 mm. ^[113]

Propolis Sp.

Propolis, sometimes referred to as "bee glue," is a resinous material that honey bees make by mixing saliva and beeswax with exudate that they gather from tree buds, sap flows, and other botanical sources. It is used as a sealer on unwanted open spaces within the hive. Propolis fills small gaps, around 6 mm (1/4 inches) or less; burr comb fills gaps larger than the bee space, about 9 mm (3/8 inches). It comes in a range of colors, the most popular being dark brown, depending on the botanical source. Below 19 °C (66 °F), propolis becomes brittle and hard, while beyond that temperature, it becomes sticky. In order to produce nectar and pollen, worker bees gather water and plant resin. ^[114] Propolis sp. has been used in traditional medicine in various parts of the world. This study demonstrates that *Propolis sp.* from several geographic locations Brazil, Australia, China, Hungary, New Zealand, South Africa, Uruguay, Thailand, the United States, and Uzbekistan. Propolis is to enhance health and fend against ailments like cancer, diabetes, heart disease, and inflammation. Chemical antioxidants such as kaempferol. ^[115] Propolis ethanol

extracts (EEP) were evaluated for their antioxidant qualities by employing the β -carotene bleaching and 1,1-diphenyl-2-picrylhydrazyl (DPPH) free radical scavenging assays. Mass spectrometric (MS) detection combined with HPLC analysis and an effective photo-diode array (PDA) allowed for the discovery and quantification of most of the antioxidant components in EEP.

Zingiber Officinale L. (Ginger)

The belonged to Zingiberaceae family includes the genus *Zingiber*. It is native to Southeast Asia, specifically the Indian Subcontinent, China, Thailand, and New Guinea. It contains actual gingers, which are plants grown for their culinary qualities around the world. The two most well-known species of garden ginger are *Z. officinale* and *Z. mioga*. The scientific name for common ginger is (*Zingiber officinale* (L.) Rosce). The primary phenolic chemicals that give ginger its different bioactivities are gingerols, shogaols, and paradols. ^[116] the roots contain chemicals called polyphenols, which have strong antioxidant properties. In particular, 6-gingerol and its derivatives are present. Analyses conducted in vitro demonstrated that ginger extract might reduce the effects of peroxidation of lipids and free radicals. Since it functions as a scavenger of free radicals, it could be able to stop or lessen injury in a human system. Significant amounts of polyphenols have been found in the ginger carbon dioxide extract, according to a study. It was capable of both significantly reducing and scavenging DPPH at a high level. During the initial phases of fat oxidation, the extract may be helpful as an antioxidant. Ginger extract exhibited antioxidant activity comparable to that of BHT in preventing lipid peroxidation at both moderate and high temperatures (37 and 80°C). It's possible that the stage of fat auto-oxidation where secondary product formation was most impeded. ^[117]

Solanum Lycopersicum (Tomatoes)

Karsten's lycopersicum (L.) is a scientific name, locally known as tomatoes, the distinctive red colour of tomatoes is caused by these carotenoids and other antioxidants like lycopene. ^[118] Vegetables that can be eaten raw or cooked include tomatoes (*Solanum lycopersicum*), sometimes referred to as tomatoes. Tomato antioxidant components have received a lot of eating fruits and vegetables, especially tomatoes, on a regular basis may help reduce the risk of cancer and cardiovascular disease. Tomato peels have a higher concentration of lycopene than tomato pulp or seeds. Other important components that contribute to these properties include flavonoids, phenolics, lycopene, and vitamins C and E. It was also discovered that tomato skin and seeds included essential amino acids, with the tomato seeds having particularly high concentrations of minerals (Fe, Mn, Zn, and Cu) and monounsaturated fatty acids (specifically, oleic acid). According to a study, antioxidants are widely distributed in seed extract and skin. The amount of all major antioxidants in processed goods and foods intended for home consumption may rise by 40% to 53% when skin and seed extracts are added. ^[119-20]

CONCLUSION:

In these paper studies on role of the natural antioxidants play in both preventing and improving general health. Because they may shield the body against oxidative stress and inflammation, naturally occurring antioxidants found in foods including fruits, vegetables, herbs and seeds have been the focus of the whole study. These consist of beta-carotene, flavonoids, and vitamins C and E. They've been linked to a decreased risk of chronic conditions like cancer, heart disease, and neurological issues. Antioxidants scavenge free radicals and prolong life, preventing oxidative damage to DNA and cells. The review may also emphasize the synergistic advantages of consuming a variety of foods cantoning strong antioxidants, as different antioxidants may interact to improve their protective effects. This entails consuming a range of fruits and vegetables each day. Consume meals rich in antioxidants to enhance your health. Because recent research carried out in field of antioxidants increases knowledge about naturally healthy compound that are available in food.

REFERENCE:

1. Fieldhouse P. Food and nutrition: customs and culture. USA: Springer 2013.
2. Dickinson B. How to grow & eat your own super foods. UK: Grub Street Publishers 2018.
3. Antioxidant-Free Radical Scavenger [updated on 2013 march 1; cited on 2013 march 20].
4. K.M. Sachaich. Bailey's Industrial Oil and Fat Products, Ed. Shahidi Fereidoon. John Wiley & Sons, Inc. 2005.
5. Phillip J. Diet high in antioxidants slashes heart disease risk in women, 2012.
6. Grozeac MB. Antioxidant (Antiradical) Compounds. Journal of Bioequivalence & Bioavailability, 2012.
7. Yadav A, Kumari R, Ashwani M, Srivastva, Prabha. Antioxidants and its functions in human body. Research in Environment and Life Science. 2016; 9(11):1328- 1331.
8. Mamata Mukhopadhyay. Natural Extracts Using Supercritical Carbon Dioxide. CRC Press LLC. 2000. <https://www.xiahepublishing.com/2572-5505/JERP-2022-00028#JERP-22-28-f1>.
9. Agati, G.; Azzarello, E.; Pollastri, S.; Tattini, M. Flavonoids as antioxidants in plants: Location and functional significance. Plant Sci. 2012, 196, 67–76.
10. Seddon JM, Ajani UA, Sperduto RD. Dietary carotenoids, vitamins A, C, and E, and advanced agerelated macular degeneration. Eye Disease Case-Control Study Group. JAMA 1994; 272(18):1413-1420.
11. Wiśniewska A., Subczyński W.K. Effects of polar carotenoids on the shape of the hydrophobic barrier of phospholipid bilayers. Biochim. Biophys. Acta. 1998; 1368:235–246.
12. Wiśniewska A., Subczyński W.K. Accumulation of macular xanthophylls in unsaturated membrane domains. Free Radic. Biol. Med. 2006; 40:1820–1826.
13. Guest J, Grant R. Carotenoids and neurobiological health. The Benefits of Natural Products for Neurodegenerative Diseases 2016; 12:199-228.

14. Scalbert A, Manach C, Morand C, Remesy C. Dietary polyphenols and the prevention of diseases. *Crit Rev Food Sci Nutr*. 2005; 45:287–306.
15. Spencer JP, Abd El Mohsen MM, Minihaane AM, Mathers JC. Biomarkers of the intake of dietary polyphenols: strengths, limitations and application in nutrition research. *Br J Nutr*. 2008; 99:12–22.
16. John P. Rafferty, ed. (2011): Minerals; p. 1. In the series Geology: Landforms, Minerals, and Rocks. Rosen Publishing Group. ISBN 978-1-61530-489 https://en.m.wikipedia.org/wiki/Mineral#cite_ref-wenk_2-0
17. Liguori I, Russo G, Curcio F, Bulli G, Aran L, Della-Morte D, et al. Oxidative stress, aging, and diseases. *Clin Interv Aging*. 2018; 13:757–72.
18. Santos-Sanchez NF, Salas-Coronado R, Villanueva Canongo C, Hernandez-Carlos B. Antioxidant Compounds and Their Antioxidant Mechanism. *Antioxidants*. London, UK: Intech Open; 2019.
19. Kimb T.S., Deckerc E.A., Leea J. Antioxidant capacities of α -tocopherol, trolox, ascorbic acid, and ascorbyl palmitate in riboflavin photosensitized oil-in-water emulsions. *Food Chem*. 2012; 133:68–75.
20. Courderot-Masuyer C, Dalloz F, Maupoil V, Rochette L. Antioxidant properties of aminoguanidine. *Fundam Clin Pharmacol*. 2009; 13:535–40.
21. Alidoost F, Gharagozloo M, Bagherpour B, Jafarian A, Sajjadi SE, Hourfar H, et al. Effects of silymarin on the proliferation and glutathione levels of peripheral blood mononuclear cells from β -thalassemia major patients. *Int Immunopharmacol*. 2006; 6:1305–10.
22. Ghasemian M., Owlia S., Owlia M.B. Review of anti-inflammatory herbal medicines. *Adv. Pharmacol. Sci*. 2016; 2016:9130979.
23. Yattoo M., Gopalakrishnan A., Saxena A., Parrray O.R., Tufani N.A., Chakraborty S., Tiwari R., Dhama K., Iqbal H. Anti-inflammatory drugs and herbs with special emphasis on herbal medicines for countering inflammatory diseases and disorders- A review. *Recent Pat. Inflamm. Allergy Drug Discov*. 2018; 12:39–58.
24. Golfakhrabadi F, Yousefbeyk F, Mirnezami T, Laghaei P, Hajimahmoodi M, Khanavi M. Antioxidant and antiacetylcholinesterase activity of *Teucrium hyrcanicum*. *Pharm Res*. 2015; 7:15–9.
25. Liu R.H. Whole grain phytochemical and health. *J. Cereal Sci*. 2007; 46:207–219.
26. Tassell MC, Kingston MC, Gilroy D, Lehane M, Furey A. Hawthorn (*Crataegus* spp.) in the treatment of cardiovascular disease. *Pharmacogn Rev*. 2010; 4:3241.
27. Li Y, Ma D, Sun D, Wang C, Zhang J, Xie Y, et al. Total phenolic, flavonoid content, and antioxidant activity of flour, noodles, and steamed bread made from different colored wheat grains by three milling methods. *Crop J*. 2015; 3:328–34
28. Kocaadam B., Şanlıer N. Curcumin, an active component of turmeric (*Curcuma longa*), and its effects on health. *Crit. Rev. Food Sci. Nutr*. 2017; 57:2889–2895.
29. Li Y, Ma D, Sun D, Wang C, Zhang J, Xie Y, et al. Total phenolic, flavonoid content, and antioxidant activity of flour, noodles, and steamed bread made from different colored wheat grains by three milling methods. *Crop J*. 2015; 3:328–34. <https://doi.org/10.1016/j.cj.2015.04.004>
30. Ruby, A. J., Kuttan, G., Babu, K. D., Rajasekharan, K. N., & Kutta, R. (1995). Anti-tumour and antioxidant activity of natural curcuminoids. *Cancer Letters*, 94(1), 79–83
31. Zugić A., Đorđević S., Arsić I., Marković G., Živković J., Jovanović S., Tadić V. Antioxidant activity and phenolic compounds in 10 selected herbs from Vrujci Spa, Serbia. *Ind. Crops Prod*. 2014; 52:519–527.
32. Barros L., Carvalho A.M., Ferreira I.C.F.R. Comparing the composition and bioactivity of *Crataegus monogyna* flowers and fruits used in folk medicine. *Phytochem. Anal*. 2011; 22:181–188.
33. Liu P., Kallio H., Lü D., Zhou C., Yang B. Quantitative analysis of phenolic compounds in Chinese hawthorn (*Crataegus* spp.) fruits by high performance liquid chromatography-electrospray ionisation mass spectrometry. *Food Chem*. 2011; 127:13701377.
34. Baby B, Antony P, Vijayan R. Antioxidant and anti-cancer properties of berries. *Crit Rev Food Sci Nutr*. 2018; 58:2491–507.
35. Xia E.Q., Deng G.F., Guo Y.J., Li H.B. Biological activities of polyphenols from grapes. *Int. J. Mol Sci*. 2010; 11:622–646.
36. Leifert W.R., Abeywardena M.Y. Cardioprotective actions of grape polyphenols. *Nutr. Res*. 2008; 28:729–737.
37. Unusan N. Proanthocyanidins in grape seeds: an updated review of their health benefits and potential uses in the food industry. *J Funct Foods*. 2020; 67:103861.
38. Melendez PA, Capriles VA. Antibacterial properties of tropical plants from Puerto Rico. *Phytomedicine*. 2006; 13:272–276.
39. Rezgui M, Majdoub N, Mabrouk B, Baldisserotto A, Bino A, Ben Kaab LB, et al. Antioxidant and antifungal activities of marrubiin, extracts and essential oil from *Marrubium vulgare* L. against pathogenic dermatophyte strains. *J Mycol Med*. 2020; 30:
40. Thorat I. Antioxidants, their properties, uses in food products and their legal implications. *Int J Food Stud*. 2013; 2:81–104.
41. Nejatizadeh-Barandozi F. Antibacterial activities and antioxidant capacity of Aloe vera. *Org Med Chem Lett*. 2013; 3:5 100927.
42. Rashid F, Dhanapal K, Sravani K, Kawkabul S. Potato and ginger peels: a potential new source of natural antioxidants. *MOJ Food Process Technol*. 2017; 4:001.003.

43. Lemberkovics E, Kéry A, Marczal G, Simándi B, Szöke E. Phytochemical evaluation of essential oils, medicinal plants and their preparations. *Acta Pharm Hung.* 1998; 68:141–149.
44. Baser KH, Demirci B, Iscan G, et al. The essential oil constituents and antimicrobial activity of *Anthemis aciphylla* BOISS. *Var. discoidea* BOISS. *Chem. Pharm. Bull. (Tokyo)* 2006; 54:222–225.
45. Al-Dabbagh B, Elhaty IA, Elhaw M, Murali C, Mansoori AA, Awad B, et al. Antioxidant and anti-cancer activities of chamomile (*Matricaria recutita* L.). *BMC Res Notes.* 2019; 12:3.
46. Lanza B. Nutritional and sensory quality of table olives. In: Muzzalupo I., editor. *Olive Germplasm—The Olive Cultivation, Table Olive and Olive Oil Industry in Italy.* InTech; Rijeka, Croatia: 2012. pp. 343–372.
47. Lins PG, Pugine SMP, Scatolini AM, Melo MP. In vitro antioxidant activity of olive leaf extract (*Olea europaea* L.) and its protective effect on oxidative damage in human erythrocytes. *Heliyon.* 2018; 4: e00805.
48. Mechergui K, Coelho JA, Serra MC, et al. Essential oils of *Origanum vulgare* L. subsp. *glandulosum* (Desf.) Ietswaart from Tunisia: chemical composition and antioxidant activity. *J Sci Food Agric.* 2010; 90(10):1745–1749.
49. Preedy V. Essential oils in food preservation, flavor and safety. Boston, MA: Academic Press; 2016.p. 625–31.
50. Pandino G., Lombardo S., Mauro R.P., Mauromicale G. Variation in polyphenol profile and head morphology among clones of globe artichoke selected from a landrace. *Sci. Hortic.* 2012; 138:259–265.
51. Petropoulos S.A., Pereira C., Ntatsi G., Danalatos N., Barros L., Ferreira I.C.F.R. Nutritional value and chemical composition of Greek artichoke genotypes. *Food Chem.* 2018; 267:296–302.
52. Salekzamani S, Ebrahimi-Mameghani M, Rezazadeh K. The antioxidant activity of artichoke (*Cynara scolymus*): a systematic review and meta-analysis of animal studies. *Phytother Res.* 2019; 33:55–71.
53. Tan ES Abdullah a Maskat MY Effect of drying methods on total antioxidant capacity of bitter melon (*Momordica charantia*) fruit. *AIP Conference Proceedings.* 2013; 1571:710–716.
54. Horax R, Hettiarachchy N, Over K, Chen P, Gbur E. Extraction, Fractionation and Characterization of Bitter Melon Seed Proteins. *J Agric Food Chem.* 2010; 58:18927.
55. Machu L., Misurcova L., Vavra Ambrozova J., Et Al. Phenolic Content and Antioxidant Capacity in Algal Food Products. *Molecules.* 2015; 20(1):1118–1133.
56. Korpelainen H, Pietilainen M. Sorrel *Rumex Acetosa* L.: Not Only a Weed but a Promising Vegetable and Medicinal Plant. *The Botanical Review.* 2020; 86:234–46. <https://doi.org/10.1007/S12229-020-09225-Z>.
57. [https://en.wikipedia.org/wiki/Berry_\(Botany\)#:~:Text=A%20plant%20that%20bears%20berries,Is%20any%20small%20edible%20fruit.](https://en.wikipedia.org/wiki/Berry_(Botany)#:~:Text=A%20plant%20that%20bears%20berries,Is%20any%20small%20edible%20fruit.)
58. Keservani RK, Sharma AK, Kesharwani RK. Medicinal Effect of Nutraceutical Fruits for the Cognition and Brain Health. *Scientifica.* 2016; 2016:3109254.
59. Sahpaz S., Garbacki N., Tits M., Bailleul F. Isolation and Pharmacological Activity of Phenylpropanoid Esters from *Marrubium Vulgare*. *Journal of Ethnopharmacology.* 2002; 79(3):389–392.
60. Eswaranandam S., Hettiarachchy N. S., Johnson M. G. Antimicrobial activity of citric, lactic, malic, or tartaric acids and nisin-incorporated soy protein film against *Listeria monocytogenes*, *Escherichia coli* O157:H7, and *Salmonella gaminara*. *Journal of Food Science.* 2004; 69:79–84.
61. Meamarbashi A, Rajabi A. The Effects of Peppermint on Exercise Performance. *J Int Soc Sports Nutr.* 2013; 10:15.
62. Sweetie R, Ramesh Ch, Sharma A. Antioxidant Potential of Mint *Mentha Spicata* L. In Radiation Processed Lamb Meat. *Food Chem.* 2007; 100:451–8. <https://doi.org/10.1016/J.Foodchem.2005.09.066>.
63. Garcia-Nicolas M., Ledesma-Escobar C.A., Priego-Capote F. Spatial Distribution and Antioxidant Activity of Extracts from Citrus Fruits. *Antioxidants.* 2023; 12:781.
64. Comert ED, Mogol BA, Gökmen V. Relationship between Color and Antioxidant Capacity of Fruits and Vegetables. *Curr Res Food Sci.* 2020; 2:1–10.
65. Reiter R.J., Manchester L., Tan D.-X. Melatonin in Walnuts: Influence on Levels of Melatonin and Total Antioxidant Capacity of Blood. *Nutrition.* 2005; 21:920–924.
66. Li L., Tsao R., Yang R., Liu C., Zhu H., Young J.C. Polyphenolic Profiles And Antioxidant Activities Of Heartnut (*Juglans Ailanthifolia* Var. *Cordiformis*) And Persian Walnut (*Juglans Regia* L.) *J. Agric. Food Chem.* 2006; 54:8033–8040.
67. Amaral J.S., Casal S., Pereira J.A., Seabra R.M., Oliveira B.P. Determination of sterol and fatty acid compositions, oxidative stability, and nutritional value of six walnut (*Juglans regia* L.) cultivars grown in Portugal. *J. Agric. Food Chem.* 2003; 51:7698–7702.
68. Bou Abdallah I., Tlili N., Martinez-Force E., Rubio A.G.P., Perez-Camino M.C., Albouchi A., Boukhchina S. Content of carotenoids, tocopherols, sterols, triterpenic and aliphatic alcohols, and volatile compounds in six walnuts (*Juglans regia* L.) varieties. *Food Chem.* 2015; 173:972–978.
69. Mayhew AJ, de Souza RJ, Meyre D, et al. A systematic review and meta-analysis of nut consumption and incident risk of CVD and all-cause mortality. *Br J Nutr* 2016; 115:212–225.
70. Montefiori M, McGhie TK, Costa G, and Ferguson AR. Pigments in the fruit of red fleshed kiwifruit (*Actinidia chinensis* and *Actinidia deliciosa*) *J Agric Food Chem.* 2005; 53(24):9526–9530.
<https://en.wikipedia.org/wiki/Kiwifruit>
71. Ferguson AR, Ferguson LR. Is kiwifruit really good for you? *Acta Horticulturae* 2003; 610:131–138.
72. Geleijnse, Launer, Hofman, Pols, & Witteman, 1999

73. Chen CY, Lapsley K, Blumberg J. A nutrition and health perspective on almonds. *Journal of the Science of Food and Agriculture* 2006; 86:2245-2250.
74. Winarsi H. Yogyakarta: Kanisius; 2007. Natural Antioxidants and Free Radicals.
75. Duester KC. Avocado fruit is a rich source of betasitosterol. *J. Am. Diet. Assoc* 2001; 101:1000-1001. Products of avocado pulp include the paste, puree, and guacamole
76. Yadav A., Kumari R., Yadav A., Mishra J.P., Srivastava S., Prabha S. Antioxidants, and its functions in human body—A Review. *Res. Environ. Life*. 2016; 9:1328– 1331.
77. Das D, Sahu D, Baruah D, Ray C, Rai S, Hazra J. Moringa olifera (Shigru): A miracle tree for its Nutritional, Ethnomedicinal and Therapeutic importance, *International Journal of Development Research* 2017;7(11):16823-16827
78. Afanas'ev I.B., Dcrozko A.I., Brodskii A.V., Kostyuk V.A., Potapovitch A.I. Chelating and free radical scavenging mechanisms of inhibitory action of rutin and quercetin in lipid peroxidation. *Biochem. Pharmacol.* 1989; 38:1763–1769. <https://en.wikipedia.org/wiki/Mango>
79. Rao AV, Rao LG. Carotenoids and human health. *Pharmacol. Res* 2007; 55:207 - 216.
80. Sommer A., Vyas K.S. A global clinical view on vitamin A and carotenoids. *Am. J. Clin. Nutr.* 2012; 96:1204S–1206S. <https://en.wikipedia.org/wiki/Carrot>
81. Anand Prakash, Revathy Baskaran. Acerola, an untapped functional superfruit: a review on latest frontiers *Food Sci Technol* 2018; 55(9):3373-3384
82. Gil MI, Ferreres F, Tomas-Barberan FA. Effect of postharvest storage and processing on the antioxidant constituents (flavonoids and vitamin C) of fresh-cut spinach. *J Agric Food Chem.* 1999; 47:2213–2217. <https://en.wikipedia.org/wiki/Spinach>
83. Gaikwad PS, Shete RV, Otari KV. Spinacia oleracea linn: A pharmacognostic and pharmacological overview, review article, *International Journal of Research in Ayurveda & Pharmacy* 2010; 1(1):78-84
84. Yao Y, Sang W, Zhou M, Ren G. Phenolic composition and antioxidant activities of 11 celery cultivars. *J Food Sci.* 2010; 75:C9–C13.
85. Jung WS, Chung IM, Kim SH, Kim MY, Ahmad A, Praveen N. In vitro antioxidant activity, total phenolics and flavonoids from celery (*Apium graveolens*) leaves. *Journal of Medicinal Plants Research* 2011; 5(32):7022- 703.
86. Mageney V., Neugart S., Albach D.C. A guide to the variability of flavonoids in Brassica oleracea. *Molecules.* 2017; 22:252.
87. Daniel Alberto Jacobo-Velázquez. Kale: An excellent source of vitamin C, pro- vitamin A, lutein and glucosinolates, *Journal of Food* 2014.
88. Hedges L, Lister C. 2007. The nutritional attributes of Allium species. Crop and food research confidential report. 1814. New Zealand Institute for Crop & Food Research Limited.
89. Gülsen A, Makris DP, Kefalas P. Biomimetic oxidation of quercetin: Isolation of a naturally occurring quercetin heterodimer and evaluation of its in vitro antioxidant properties. *Food Research International* 2007; 40:7-1.
90. Grinstein S, Martín-Belloso O, Park YS, Haruenkit R, Lojek A, Číž M, Caspi A, Libman I, Trakhtenberg S. Comparison of some biochemical characteristics of different citrus fruits. *Food Chem.* 2001; 74:309–315.
91. Rampersaud GC. A comparison of nutrient density scores for 100% fruit juices. *J Food Sci* 2007; 72: S261-S266.
92. Colombo R.C., Roberto S.R., Nixdorf S.L., Pérez-Navarro J., Gómez-Alonso S., Mena-Morales A. Hermosín-Gutiérrez I. Analysis of the phenolic composition and yield of 'BRS Vitoria' seedless table grape under different bunch densities using HPLC–DAD–ESI-MS/MS. *Food Research International.* 2020; 130:108955.
93. Marambaud P, Zhao H, Davies P. Resveratrol promotes clearance of Alzheimer's disease amyloid-beta peptides. *J Biol Chem* 2005; 280(45):373:77-82.
94. Srivastava A, Akoh CC, Fischer J, Krewer G. Effect of anthocyanin fractions from selected cultivars of Georgia-grown blueberries on apoptosis and phase II enzymes. *J Agric Food Chem.* 2007; 55(8):3180–3185.
95. Pojer E, Mattivi F, Johnson D, Stockley CS. The case for anthocyanin consumption to promote human health: a review. *Compr Rev Food Sci Food Saf* 2013; 12:483-508.
96. Newman RA, Lansky EP, Block ML. Pomegranate: The Most Medicinal Fruit. Laguna Beach, California: Basic Health Publications; 2007. -A Wealth of Phytochemicals; p.120.
97. Sumner MD, Elliott-Eller M, Weidner G, Daubenmier JJ, Chew MH, Marlin R, et al. Effects of pomegranate juice consumption on myocardial perfusion in patients with coronary heart disease. *Am J Cardiol* 2005; 96(6):810-4.
98. Česonienė L., Daubaras R. Phytochemical composition of the large cranberry (*Vaccinium macrocarpon*) and the small cranberry (*Vaccinium oxycoccos*) In: Simmonds M.S.J., Preedy V.R., editors. *Nutritional Composition of Fruit*. Academic Press; Cambridge, MA, USA: 2016. pp. 173–194. Chapter 8. <https://en.wikipedia.org/wiki/Cranberry>
99. Wang CH, Fang CC, Chen NC, Liu SS, Yu PH, Wu TY, et al. Cranberry-containing products for prevention of urinary tract infections in susceptible populations: a systematic review and meta-analysis of randomized controlled trials. *Arch Intern Med* 2012; 72:988-96.
100. Raudone L., Raudonis R., Liaudanskas M., Janulis V., Viskelis P. Phenolic Antioxidant Profiles in the Whole Fruit, Flesh and Peel of Apple Cultivars Grown in Lithuania. *Sci. Hortic.* 2017; 216:186–192.

101. Kalinowska M., Gryko K., Wróblewska A.M., Jabłońska-Trypuć A., Karpowicz D. Phenolic Content, Chemical Composition and Anti-/pro-Oxidant Activity of Gold Milenium and Papierowka Apple Peel Extracts. *Sci. Rep.* 2020; 10:14951.
102. Singleton, V. L., & Rossi, J. A. (1965). Colorimetry of total phenolics with phosphomolybdic-phosphotungstic acid reagents. *American Journal of Enology and Viticulture*, 16(3), 144–158.
103. Slavin J.L. Mechanisms for the impact of whole grain foods on cancer risk. *Journal of the American College of Nutrition* 2000; 19, 300S-307S
104. Quispe, C., Herrera-Bravo, J., Javed, Z., Khan, K., Raza, S., GulsunogluKonuskan, Z., Daştan, S. D., Sytar, O., Martorell, M., Sharifi-Rad, J., & Calina, D. (2022). Therapeutic applications of curcumin in diabetes: A review and perspective. *BioMed Research International*, 2022, 1375892
105. Sánchez-Rangel J.C., Benavides J., Heredia J.B., Cisneros-Zevallos L., Jacobo Velázquez D.A. The Folin–Ciocalteu assay revisited: Improvement of its specificity for total phenolic content determination. *Anal. Methods*. 2013; 5:5990–5999.
106. Prado, A. C. P., Arragao, A. M., Fett, R., & Block, J. M. (2009). Antioxidant properties of Pecan nut [*Carya illinoensis* (Wangenh.) C. Koch] Shell infusion. *Grasas y Aceites*, 60(4), 330–335.
107. Nicoli M.C., Anese M., Manzocco L., Lerici C.R. Antioxidant properties of coffee brews in relation to the roasting degree. *Lebensm. Wiss. Technol.* 1997; 30:292 – 297.
108. Steinhart H., Luger A., Piost J. Antioxidative Effect of Coffee Melanoidins; Proceedings of the 19th International Scientific Collogue on Coffee; Trieste, Italy. 14 18 March, 2001.
109. Daglia, M., Papetti, A., Gregotti, C., Berte, F., & Gazzani, G. (2000). In vitro antioxidant and ex vivo protective activities of green and roasted coffee. *Journal of Agricultural and Food Chemistry*, 48, 1449–1454.
110. Ellis C.L., Edirisinghe I., Kappagoda T., Burton-Freeman B. Attenuation of meal- induced inflammatory and thrombotic responses in overweight men and women after 6-week daily strawberry (*Fragaria*) intake. *J. Atheroscler. Thromb.* 2011; 18:318 327.
111. Scheau, C., Badarau, I. A., Mihai, L. G., Scheau, A. E., Costache, D. O., Constantin, C., Calina, D., Caruntu, C., Costache, R. S., & Caruntu, A. (2020). Cannabinoids in the Pathophysiology of Skin Inflammation. *Molecules*, 25(3), 652. <https://doi.org/10.3390/molecules25030652>
112. Ramchandani AG, Chettiyar RS, Pakhale SS. Evaluation of antioxidant and anti- initiating activities of crude polyphenolic extracts from seedless and seeded Indian grapes. *Food Chem.* 2010; 119:298–305.
113. Li, L., Tsao, R., Yang, R., Liu, C. M., Zhu, H. H., & Young, J. C. (2006). Polyphenolic profiles and antioxidant activities of heartnut (*Juglans ailanthifolia* var. *cordiformis*) and Persian walnut (*Juglans regia* L.). *Journal of Agricultural and Food Chemistry*, 54, 8033–8040.
114. Rzepecka-Stojko A., Stojko J., Kurek-Górecka A., et al. Polyphenols from bee pollen: structure, absorption, metabolism and biological activity. 2015; 20(12):21732 21749.
115. Kumazawa, S., Hamasaka, T., & Nakayama, T. (2004). Antioxidant activity of propolis of various geographic origins. *Food Chemistry*, 84, 329–339.
116. Stoner G.D. Ginger: Is it ready for prime time? *Cancer Prev. Res.* 2013; 6:257–262.
117. Fuhrman, B., Rosenblat, M., Hayek, T., Coleman, R., & Aviram, M. (2000). Ginger extract consumption reduces plasma cholesterol, inhibits LDL oxidation and attenuates development of atherosclerosis in atherosclerotic, apolipoprotein E-deficient mice. *Journal of Nutrition*, 130, 1124–1131.
118. Kucuk, O.; Sarkar, F.; Sakr, W.; Djuric, Z.; Pollak, M.; Khachik, F.; Li, Y.W.; Banerjee, M.; Grignon, D.; Bertram, J.S.; et al. Phase II Randomized Clinical Trial of Lycopene Supplementation before Radical Prostatectomy. *Cancer Epidemiol. Biomarker. Prev.* 2001, 10, 861–868.
119. Giovannucci, E. (1999). Tomatoes, tomato-based products, lycopene, and cancer: Review of the epidemiological literature. *Journal of the National Cancer Institute*, 91, 317–331.
120. Heber, D. (2000). Colorful cancer prevention: A-carotene, lycopene and lung cancer. *American Journal of Clinical Nutrition*, 72, 901–902.

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