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Antioxidants- It's Role in Food and Functions

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Introduction

Antioxidants are a class of chemicals that significantly slow down or prevent the oxidation of certain compounds and oxidative reactions when they are present at low amounts, despite frequently being oxidized themselves. Antioxidants have been widely used in the food industry for decades to protect lipids from oxidative degradation. By generating peroxides and their derivatives, free radical reactions are crucial to the oxidative destruction of lipids, which may result in the off- flavors of food. The antioxidants present in cells defend them from the negative effects of free radicals (Thorat*et al.* 2013).It has also been proposed that antioxidants play a significant function as preservatives. The US Food and Drug Administration (FDA) has designated these as preservatives that delay food degradation, rancidity, or discoloration brought on by oxidation. Antioxidants have thus been classified as compounds that terminate the free radical chain in lipid oxidation by donating electrons or hydrogen to fat containing a free radical and causing the formation of a complex between the fat chain and a free radical. Antioxidants inhibit the free radical chain of oxidative reactions by contributing hydrogen from the phenolic hydroxyl groups, forming stable free radicals that do not initiate or propagate further lipid oxidation.Butylated hydroxyanisole (BHA), butylated hydroxy toluene (BHT), tert-butylhydroquinone (TBHQ), propyl gallate (PG), and tocopherols are examples of important synthetic antioxidants in this class. Free radical interceptors do not provide all antioxidant activity. Reducing agents that work by transferring hydrogen atoms are also classified as oxygen scavengers.Ascorbyl palmitate, sulphites, ascorbic acid, glucose oxidase, and erythorbic acid are a few examples.Antioxidants are also known as chelators because they bind metal ions such as copper and iron that catalyse lipid oxidation; oxygen scavengers and also react with oxygen in closed systems. Thus, synthetic antioxidants are generally composed of phenolic structures and varying degrees of alkyl substitution. Tocopherol and ascorbic acid are both widely used as natural antioxidants, but

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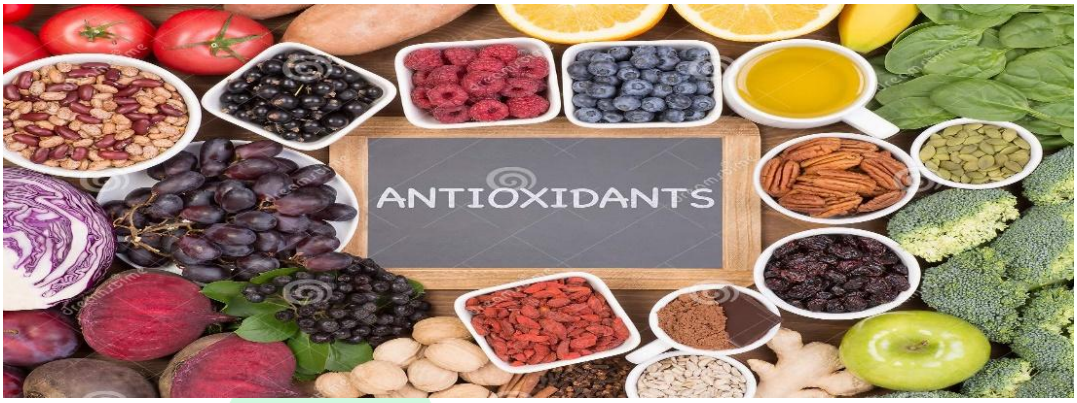
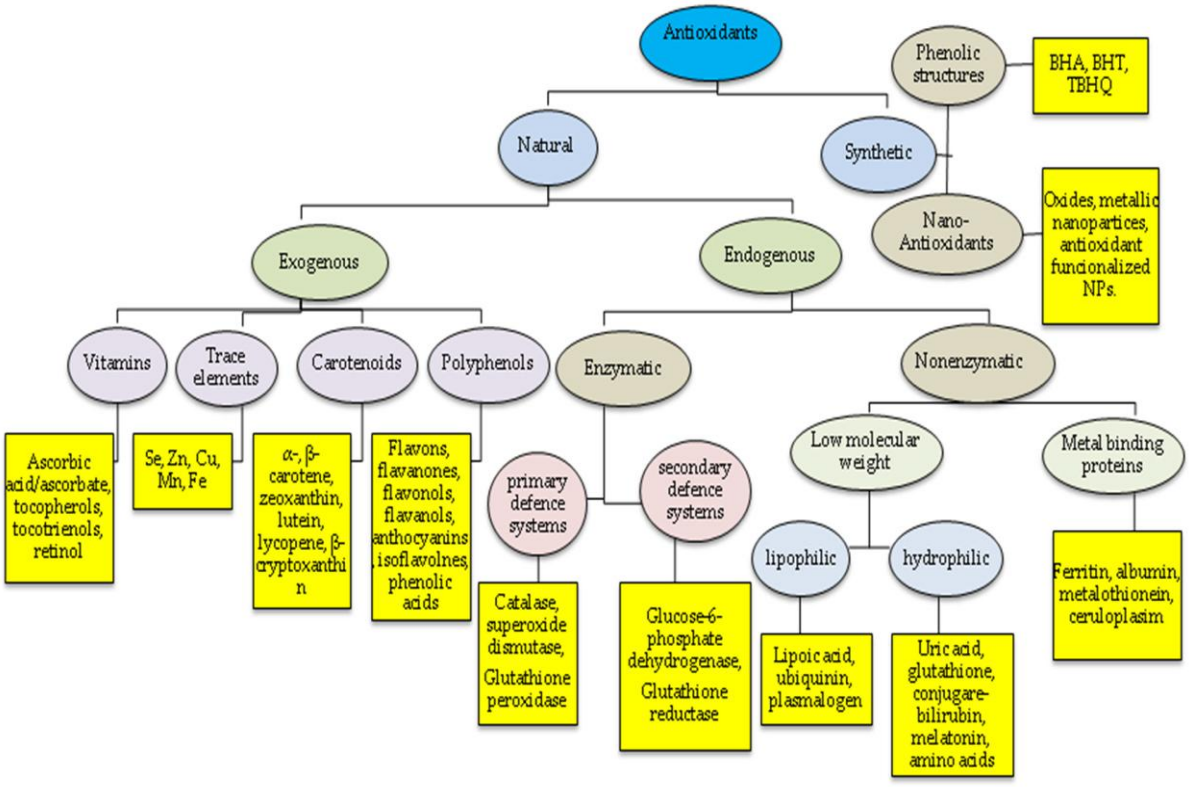
their activity is significantly lower than that of synthetic antioxidants (Kaur and Kapoor, 2001).



Antioxidant's classification



Antioxidants work by delaying or preventing other chemicals from oxidising. Antioxidant studies in biology have focused on their use in preventing unsaturated fatty acids fats from oxidising further. Antioxidants are commonly distinguished as Enzymatic and no enzymatic. Various compounds having numerous modes and places with their final effects are present among them. This variability determines the role of each individual in the body. It should be noted that the network of antioxidant enzymes that interact with one another, such as

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superoxide dismutase enzymesSODs, catalase (CAT), glutathione peroxidase (GPx), and glutathione reductase (GR) are all antioxidant enzymes (GRd),has the highest antioxidant defence efficacy.Vitamin C, E, coenzyme Q, carotenes, and other lowmolecularweight antioxidants like glutathione and trace elements are also involved in the inactivation of reactive radicals.Some of them are produced by the body, such as glutathione, ubiquinone, albumin and metallothioneins, and uric acid, but the majority provided with diet are exogenous compounds derived from natural sources such as plants (flavonoids, phenolic acids, carotenoids, stilbenes, coumarins, lignans, organosulfur compounds, vitamins) or minerals (selenium, zinc, manganese).A healthy diet rich in antioxidants includes fruits, tea, wine, vegetables, and grains. Some drugs, in addition to their therapeutic effects, have antioxidant properties, such as captopril, an angiotensin-converting enzyme (ACE) inhibitor, nacetylcysteine, or dihydropyridine calcium antagonist (Fliege*et al.* 2021).

Sources and origin of antioxidant's

Fruits, vegetables, nuts, grains, some meats, poultry, and fish all contain significant amounts of antioxidants. Many orange-colored foods contain beta-carotene, including sweet potatoes, carrots, cantaloupe, squash, apricots, pumpkin, and mangoes. Beta-carotene is also abundant in green, leafy vegetables such as collard greens, spinach, and kale.Lutein, which is best known for its association with good vision, is abundant in green, leafy vegetables like collard greens, spinach, and kale.Lycopene is a powerful antioxidant found in tomatoes, watermelon, guava, papaya, apricots, pink grapefruit, blood oranges, and other fruits and vegetables. According to estimates, tomatoes and tomato products account for 85% of lycopene consumption in the United States. Selenium is a mineral, not a nutrient with antioxidant properties.It is, however, a component of antioxidant enzymes. In most countries, plant foods such as rice and wheat are the primary dietary sources of selenium. There are three types of vitamin A: retinol (Vitamin A1), 3,4-didehydroretinol (Vitamin A2), and 3-hydroxyretinol (Vitamin A3). Vitamin A-rich foods include liver, sweet potatoes, carrots, milk, egg yolks, and mozzarella cheese. Vitamin C, also known as ascorbic acid, is abundant in many fruits and vegetables and can also be found in cereals, beef, poultry, and fish. Vitamin E, also known as alpha-tocopherol, is present in almonds, numerous oils such as wheat germ, safflower, maize, and soybean oils, as well as mangoes, nuts, broccoli, and other foods (Hamid *et al.* 2010).

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Antioxidant-fortified fruit and vegetable products and human health

In both developed and developing countries, there is a growing interest in "natural" products, particularly those high in phytochemicals and antioxidants such astea, shrubs, wine, and fruit juice are examples of antioxidant-rich natural products.A few examples of innovative high antioxidant fruit constituents are acaiberries, wolfberries, pomegranate concentrations, and pomegranate, cranberry, and blueberry extracts. Wolfberries are high in carotenoids, lutein, and zeaxanthin, whereas acai berries are similar to other dark-colored fruits because they are rich in anthocyanins.Sea buckthorn and baobab fruit powder are two additional newly developed beneficial beverage additives. Significant levels of tocopherols, tocotrienols, and carotenoids can be found in sea buckthorn. These nutrients are present in processed vegetable products in amounts that the body can use to great effect. Fruit juice and other beverages can be biofortified with vitamin C. However, it is believed that naturally occurring antioxidants derived from plants and reliant on the amount consumed are safer and healthier than antioxidants produced through chemical synthesis. Red, blue, purple, and black artificial colourants used in fruits and vegetables products in the food sector can be substituted with fruits high in anthocyanins, such as blue honeysuckle, blueberry, and lingberry (Jideani *et al.* 2021).

Antioxidants components in food

Numerous food ingredients, including tocopherol, tocotrienol, ascorbic acid, carotene, and other substances like ubiquinol and phenolic compounds, have antioxidant properties. Some micronutrients, such as selenium, copper, iron, manganese, and zinc, function as cofactors or are included as part of their prosthetic groupsthus, nutrition plays a critical role in the maintenance of antioxidant enzymes. Micronutrient deficiency can impair the enzyme defence system. The most powerful natural antioxidants are phenolic compounds and ascorbic acid. Carotenoids, protein-related compounds, Maillard reaction products, phospholipids, and sterols are all naturally occurring antioxidants found in foods. Antioxidants gained from nutrition can have a variety of effects, including reducing an excess of free radicals and preventing oxidative cell damage. Secondly, after damage has occurred, antioxidants can control free radical levels, preventing further damage and alleviating some oxidative stress symptoms. Polyphenols are a heterogeneous group of molecules made up of aromatic rings that have been substituted with a hydroxyl group. Depending on their

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structure, phenolic compounds are classified into several types. The most important are phenolic acids and flavonoids (found primarily in vegetables), which can be found on the surface layers of vegetables, fruits, cereals, and other seeds. Their purpose is to keep the lower layers from oxidising.Polyphenols in food help with acidity, astringency, colour, flavour, odour, and oxidative stability. There are also estrogenic substances (phytoestrogens) such as isoflavones, lignans, and the stilbene resveratrol, whereas others, such as tannins, can bind to metals and proteins, affecting their bioavailability and leading to some unspecific effects such as antimicrobials or the prevention of neurodegenerative diseases (chib*et al.* 2020).

Function of antioxidants

In order to avoid these disorders, the Food and Drug Administration (FDA) only classifies antioxidants as dietary supplements to be taken in addition to regular food consumption. The protective effects of plant diets are known to be significantly influenced by antioxidants (Yadav *et al.* 2016) Some functions of antioxidant's are:

- It reduces the free radicals.
- It stimulates the growth of normal cells.
- Protects cells against premature and abnormal ageing.
- Helps fight against cancer.
- It supports the body immune system.
- Antioxidants may help to lowerchances of AMD (age-related macular degeneration) by up to 25%.
- Fights against many heart diseases.

Conclusion

Antioxidants, even at low concentrations, limit the oxidation process. Plants rich in vitamins (C, E, carotenoids, and so on), flavonoids (flavones, isoflavones, flavanones, anthocyanins, and catechins), and polyphenols (ellagic acid, gallic acid, and tannins) have high antioxidant activity. Antioxidants are thought to play a critical function in the body's defence mechanism against reactive oxygen species (ROS), which are damaging by-products of regular cell aerobic respiration. Increasing dietary antioxidant consumption may aid in the maintenance of a sufficient antioxidant status and, as a result, the normal physiological function of a living system.

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