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The Role of Antioxidants in Biological System

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ABSTRACT
Antioxidants are chemicals that prevent or slow down the oxidation of other molecules. RONS can cause damage to biological systems. The antioxidant defence mechanism is a complex, cooperative array of antioxidant defence mechanisms.By avoiding oxidation, antioxidants remove the presence of free radicals and prevent their proliferation. Because oxidative stress is a key component of many human diseases, antioxidants can help to prevent disease by reducing oxidation in living systems. In comparison to synthetic antioxidants, natural antioxidants are also more useful. Antioxidants, free radicals, oxidative stress, and oxidation are some of the terms used in this study.
KEYWORDS *Antioxidants, Species, Neurodegeneration.*

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I. INTRODUCTION

Antioxidants are a family of chemical components found naturally in food that can help to prevent or minimise oxidative stress in the body. Because of the regular use of oxygen, the body is constantly producing free radicals.When life forms on Earth switch from anaerobic to aerobic energy sources, We paid a high price for consuming oxygen. harmful byproducts known as free radicals All of these result in significant cellular and molecular damage. Damage to the DNA. Making a bigger difference. More than 60 additional health problems, including Increased bone, organ, brain, and skin ageing Interfering with the replication of cells Antioxidants are one of the few weapons in the fight against free radicals. Antioxidants are widely acknowledged for their capacity to act as a rust oxygen species (ROS) and reactive nitrogen species (RNS) to their damaging effects.Keep the immune system in good shape, or boost the immune system when it has been compromised.Prevent age related neurodegeneration such as decline of the brain and nerve system.Prevent DNA damage and there for have anticarcinogenic effect.

FREE RANDOM RADICALS - Free radicals are chemical entities that have an unpaired electron in the outer (valence) shell of the molecule and occur when oxygen is metabolised or produced in the body. Free radicals are very reactive and can react with proteins, lipids, carbohydrates, and DNA because of this. These free radials attack and steal an electron from the nearest stable molecule. When a molecule is attacked and loses an electron, it becomes a free radical, which sets off a chain reaction that eventually destroys a live cell . [2] Free radicals can be oxygen-derived (ROS, reactive oxygen species) or nitrogen-derived (nitrogen-derived free radicals) (RNS reactive nitrogen species). O2 [superoxide], HO [hydroxyl], HO2 [hydroperoxyl], ROO [peroxyl], RO [alkoxyl], and H2O2 [hydroperoxyl] are oxygen-derived c[9]

THE REASON FOR THE GENERATION OF FREE RADICALS -Free radicals are produced naturally as part of the body's metabolic activities. These harmful organisms can be produced by synthetic (Xenobiotics) chemicals, radiation, X-rays, pollution, and even stress. Chlorinated hydrocarbons, aromatic hydrocarbons, industrial acids, additional pesticides, preservatives inputs, printing pigments and ink, and other industrial chemicals are all known to produce free radicals. Perfumes and fragrances, as well as cosmetic vehicles and cosmetics. Many, if not all, pharmacological agents used in medicine and anaesthesia pollute the air and water, causing radicals to form in the central nervous sixty-seven the ubiquitous transitional metal catalysts, iron and copper, have a very strong producing influence on chain beginning radicals.[4]

ROLE OF ANTIOXIDANTS

An antioxidant is a chemical that can prevent other molecules from oxidising. Free radicals are formed during oxidation events, and these can start chain reactions that harm cells.uenceem against oxidative stress is composed of several lines, and the antioxidants are classified into four categories based on function as follows:First line of defense is the preventive antioxidants, which suppress formation of free radical (enzymes such as glutathione peroxidase, catalase, superoxide dismutase; cartoneoids, selenoprotein, lactoferrin etc.)Second line of defense is the radical scavenging antioxidants suppressing chain initiation and/or breaking

chain propagation reactions, i.e., radical scavenging antioxidants.Third category antioxidants are repair and denovo antioxidants (some proteolytic enzymes repair enzymes of DNA, etc.)

CLASSIFICATION OF ANTIOXIDANTS

A.Enzymaticantioxidants,

B.Non Enzymatic antioxidants

ENZYMATIC ANTIOXIDANTS

The first lines of defense against O2- and H2O2- mediated injury are antioxidant enzymes like SOD, GPx and CAT.Superoxide dismutase (SOD)Superoxide dismutase (SOD) is a family of metallo-enzymes that convert O2- and H2O2- by the reaction:Increased plasma level of SOD has been reported in various diseases. Breast cancer patients have been reported to possess increased levels of plasma copper and zinc. Thus, increased production of SOD in various genetic diseases may be in response of higher production of free radicals in those disease.[7]

A.Glutathione peroxidase (GPx)

Glutathione peroxidase (GPx) is a selenium containing enzyme, which catalyses the reduction of H2O2 and lipid hydroperoxide (LO2H), generated during lipid peroxidation, to water using reduced glutathione as substrate. It is found in both cytosol and mitochondria and is a well-known first line of defense against oxidative stress, which in turn requires glutathione as a cofactor. It is involved in the generation of nucleotide precursors of DNA via the reduction of ribonucleotides.deoxyribonucleotides. GPx catalyses the oxidation of reduced glutathione (GSH) to oxidized glutathione (GSSG) at the expense of H2O2, by its selenium dependency. Since, selenium is an integral component of GPx, the measurement of this enzyme has been used as a functional index of selenium level.[5]

B.Catalase (CAT)

Catalase (CAT) is a protein that catalyses the conversion of hydrogen peroxide to water and oxygen in most cells. The following is the mechanism of action: 2H2O2 ® 2H2O + O2 ® 2H2O2 ® 2H2O2.CAT is present in mitochondria and intracellular respiratory organelles, where it acts 104 times quicker than peroxidase. CAT has been discovered to have a role in the inactivation of a variety of environmental mutagens. Both SOD and CAT enzymes have been shown to prevent plasmid DNA strand scission produced by xanthine/xanthine oxidase (XO). It also helps to avoid chromosomal abnormalities. When compared to SOD and GPx, CAT activity is shown to be lower.[8]

ANTIOXIDANTS WITHOUT ENZYMES ANTIOXIDATIVE VITAMINS:

Antioxidant vitamins have a variety of biological effects, including immunological activation and inhibition.Vitamin A is a fat-soluble vitamin that isThis fat-soluble vitamin is required for epithelial tissue growth, maintenance of vision, reproduction, and differentiation. Retinol and its esters, retinoldehyde, and retinoic acid are among them. Beta-carotene protects dark green, yellow, and orange vegetables and fruits from sun damage, and it also has a protective effect in the human body. It's a good scavenger of singlet oxygen, which is created during photosensitivity. It is thought to have a key role in carcinogenesis suppression by boosting tumour immunity through a variety of ways[.9]

A.Vitamin C is a powerful antioxidant.

Vitamin C is a water-soluble antioxidant found in biological fluids and a vital vitamin required for the body's proper metabolic functioning. It interacts directly with plasma radicals such as O2- and HO, reducing cell membrane damage. Probably.

A.Foods High in Antioxidants

A variety of antioxidants can be found in a number of foods. The most well-known antioxidants, as well as the foods that contain them, are listed below.MineralsZinc

Oysters, pork, eggs, and beans are some of the ingredients in this dish.

Lean beef

Heart of a chicken

The yolk of an egg

Fish\sHerring

Lamb

Syrup made from maple trees

Milk

Black-strap molasses

Oysters

Pork

Seeds of sesame

Soybeans

Sunflower seeds are a type of sunflower.

Turkey

Wheat bran is a type of cereal grain.

Wheat germ is a type of cereal grain.
Products made from whole grains. YeastManganese
Avocados, Barley, Beans, Blackberries, Bran, Buckwheat, Chestnuts, Cloves, Coffee, Ginger, Hazelnuts (filberts), Hazelnuts (filberts), Oatmeal, Peanuts, Peas, Pecans, Seaweed, SpinachSelenium
7 oz (903 g) roasted potato with skin
3 oz (69 g) mild tuna, water packed
3 ounces (32 g) roasted pork loin
1 (31.5 g) egg
1 ounce (22 g) toasted sunflower seed kernels
3 ounces (28 g) top sirloin, lean, grilled

ALZHEIMER'S DISEASE AND ANTIOXIDANTS

Free radicals are implicated in Alzheimer's disease for a variety of reasons. They target phospholipids, which are fat molecules found in neuron membranes. Free motion disrupts the delicate membrane machinery that governs what goes in and out of the cell, like as calcium, according to some researchers. Free radicals could possibly be linked to beta amyloid. According to one study, beta amyloid breaks easily into fragments in neuritic plaques, generating free radicals.In the fight against oxygen free radicals, the body has a line of defence. Superoxide dismutase (SOD) and catalase are enzymes that can neutralise the harmful oxygen molecule. Antioxidants like vitamin C and E, as well as beta carotene, which is related to vitamin A, are found in foods and help to fight free radicals.Carnitine acetyl-L .[11]

DIABETES AND ANTIOXIDANTS

Hyperglycemia causes the intracellular buildup of sorbitol generated by the activity of aldose reductase on glucose in type I diabetes. Sorbitol may play a role in diabetes complications. The use of an aldose reductase inhibitor appears to be therapeutically promising. Vitamin C is an efficient aldose reductase inhibitor, hence it may be useful for diabetic therapeutic intervention. Supplementing with a pharmacologic dose of 900 mg of vitamin E per day seems to be an effective way to lower oxidative stress and improve insulin function. [12]

THROMBOSIS AND ANTIOXIDANTS

Prostacyclin synthesis is reduced by lipid peroxides and vitamin E deficiency. The most powerful platelet stabiliser in the body. Prostacyclin is a protein that helps to slow down the progression of atherosclerosis. It is now known that taking 300 units of vitamin E per day for up to 18 weeks lowers platelet adhesion and increases plasma clotting time. 2 gm vitamin C per day dramatically lowers platelet aggregatory agent reaction.[8]

ASTHMA AND ANTIOXIDANTS

The respiratory tract is a prominent target for free radical activity due to its high surface area. The main cause of ROS is air pollution. According to recent research, free radicals may play a role in the development of respiratory illnesses including asthma. The bronchial inflammatory symptoms of the condition are considered to be caused in part by cellular damage produced by free radicals. Increased antioxidant consumption has been suggested as a way to reduce oxidative stress and assist avoid and decrease the onset of asthmatic symptoms. Vitamin C, E, and beta carotene have all been linked to bettering pulmonary function. Glutathione and perhaps N acetyl cystein, a precursor to glutathione, may be beneficial in preventing pulmonary damage. 11 and 12

CHEMICALS THAT ARE ANTIOXIDANT AND TOXIC

Acute and/or chronic toxicity to a variety of tissues, including those of the neurological system, liver, gastrointerstinal tract, and cardiovascular system, has been linked to the use of alcoholic beverages. Ethanol causes mytochondrial damage, hepatic lipid buildup, and macromolecule oxidative damage. It has been established that the usage of dietary antioxidants can prevent part of this harm. Adriamycin is cardiotoxic, although studies have shown that supplementing with vitamin E and selenium can minimise toxicity while maintaining antitumor activity.High oxygen tensions can be exceedingly hazardous and act as a major activator of free radical damage. Chemotherapeutic agents, digitalis, benzene, barbiturates, and aspirin have all been proven to be protected by vitamin.[6]

PREVENTING THE AGEING OF THE SKIN

According to the free radical theory, age, mutation, and damage accrue as a result of reactive oxygen species produced by organisms during aerobic metabolism. When a cell converts oxygen to energy, it produces free radicals, which are small molecules. When hazardous levels of free radicals are created, they harm the body's cellular level, resulting in cell death and tissue damage[.3]

RADICAL ABSORBANCE CAPICITY OF OXYGEN

The oxygen radical absorbance capacity (ORAC) assay, which we invented, is based on the unique features of the protein phycoerythrin (PE). To present, the ORAC assay is the only method that measures the whole reaction of free radical reactive species using a "area under the curve" (AUC) technique, combining both inhibition time and inhibition % of reactive species action by antioxidants into a single number. The ORAC assay relies on the decrease in fluorescence emission of R- or B-PE as a means of detecting chemical damage.

PE fluorescence is strongly dependent on the protein's structure and chemical integrity. Under the right circumstances, the loss of pe

ANTIOXIDANTSUPPLEMENTATION'S POSSIBLE HARMFUL EFFECTS ON HEALTH

By binding to dietary minerals in the gastrointestinal tract and inhibiting their absorption, relatively strong reducing acids can have anti-nutritional effects. Oxalic acid and phytic acid, which are abundant in plant-based diets, are two examples. This is also a bad property of some tannins. In the Middle East, where phytic acid, found in beans and unleavened whole grain bread, is consumed in large quantities, calcium and iron shortages are widespread. These anti-nutrients can lead to misleadingly high oxygen radical absorbance capacity (ORAC) ratings for a variety of "healthy" beverages and meals, including: oxalic acid is found in cocoa/chocolate, spinach, and berries. Phytic acid is found in whole grains and maize. tea - tannins Toxicity exists in other extremely potent nonpolar antioxidants, such as eugenol.[4]

II. CONCLUSION

The imbalance between ROS and antioxidant defence mechanisms can lead to an increase in oxidative load and macromolecule damage. These processes are hypothesised to play a role in the pathology of a variety of diseases. Antioxidants, which can scavenge free radicals, play a significant function in the biological system, and their use has been linked to the prevention of cancer, heart disease, and ageing, among other disorders.

By using enzymatic or non-enzymatic mechanisms, the human mechanism has an innate mechanism to minimise free radical-induced harm. When the body's natural antioxidant defence mechanisms aren't enough to prevent free radical-induced harm, antioxidant supplementation can help. Though vitamins are important in reducing free radicals, their primary job is to provide energy.[9]

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