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Role of Anioxidants Defense System

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Description

A biological antioxidant may be defined as a substance (present in low concentrations compared to an oxidizable substrate) that significantly delays or inhibits oxidation of a substrate. Substances that neutralize potential ill effect of free radicals are generally grouped in so called an Antioxidant Defense System (ADS).

Role of enzymatic antioxidants

Vitamin E: Vitamin E represents two groups of compounds called Tocopherol and Tocotrienol. Chemically tocopherols have a saturated long phytyl tail attached to a chromane ring, whereas tocotrienol have an unsaturated phytyl tail. Isomers of tocopherols and tocotrienels differ from each other based on the degree of methylation of the chromane ring. There are eight structural isomers alpha, beta, gamma, and delta etc., among these; alpha tocopherol is with the most potent antioxidant activity. High levels of tocopherol are found in selected mammalian tissues such as liver, heart, testes and adrenal glands [1]. Intracellurlarly, Vitamin E is associated with lipid rich membranes such as mitochondria and therefore anti oxidation property of tocopherol must be high in protecting against membrane lipid peroxidation.

Thus, as Vitamin E in Lipophilic in character, it protects the unsaturated fatty acids PUFAS from peroxide reacts and acts as a scavenger and gets itself oxidized to Quinone formed by free radicals Vitamin E is Essential for the membrane structure and integrity of Cell [2].

Selenium: Selenium is thought to be as essential micronutrient and it exerts benefial effects on health through is selenoproteins. The enzyme GPX is one of the most important selenoproteins in which contribution to the oxidative defence animal tissue by catalysing reduction of hydrogen and lipid peroxidation [3]. The biological antioxidant function of the selenium was confined to its interaction enzyme GSH-Px. The amino acid selenocysteine is involved in the synthesis of diverse selenoenzyme such as glutathione peroxidase (reducing peroxides) iodothyronine deiodinases (regulating thyroid hormone activity), and thioredoxin reductase (regenerating antioxidant systems). An alternate possibility is that selenium enhances the detoxification process of carcinogens substances and protects against carcinogen induced chromosomal damage.

Vitamin C (Ascorbic acid): It is hydrophilic scavenger of free radicals and act as reducing and antioxidant agent. It is essential for collagen; carnitine and neuro transmitters' biosynthesis vitamin C works synergistically with vitamin E and restores the antioxidant properties of oxidized vitamin E. Ascorbic acid reserves both antioxidant and pro-oxidant . In the presence of transition metals like Fe^{3+} or Cu^{2+} , vitamin C/ascorbic acid generates oxygen free radicals thus induce lipid per-oxidation. Synergistic action of Vitamin C and E helps in inhibition of nitrosation from nitrite i.e. inhibits N-nitro compound formation in heterogeneous mixture of water and lipid phase.

Vitamin A: Beta-carotene is a fat soluble member of the carotenoid which are considered pro vitamins therefore they can be converted to active vitamin A. Beta carotene is converted to retinol, which is essential for vision. Carotenoid acts as antioxidant because of its property to scavenge free radicals. It protects lipid against peroxidation by quenching free radicals and other reactive oxygen species, mostly singlet oxygen. Same as vitamin C, beta carotene function as both antioxidant and pro-oxidant at higher oxygen partial pressure its free radical tracking capacity shows autocatalytic pro-oxidant effect with concomitant loss of its antioxidant activity.

Role of non-enzymatic antioxidants

Catalase: Chemically it is tetramer of four polypeptide chains containing four porphyrin heme groups which allow the enzyme to react with hydrogen peroxide. Catalase is present in high amounts in the liver, kidney and

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red blood cells. In hepatocytes, peroxisomes exhibit high catalase activity as well as in microsomes and in the cytosol.

Glutathione Peroxidase: GSH-Px are classified as selenium dependent and selenium independent which catalyses the reduction of hydrogen peroxides and organic hydroperoxides [4,5]. GSH-Px is present Intracellurlarly in the cytosol and mitochondrial matrix [6].

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