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ANTIOXIDANTS ROLE IN HUMAN HEALTH: A CRITICAL REVIEW

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ABSTRACT

Antioxidants protect the living beings from damage caused by harmful molecules called free radicals, which are released as by-products during oxidation. Reactive oxygen species (ROS) or free radicals are produced by living organisms as a result of normal cellular metabolism and environmental hazards. ROS are highly reactive molecules and are capable of damaging cell structures which will alter their functions in favour of oxidants creating oxidative stress. Oxidative stress contributes too many of the pathological conditions and diseases, like cancer, neurological disorders, diabetes, etc. To protect from these free radicals aerobic organisms have evolved with having an integrated antioxidant system. To improve overall health antioxidants intake should be more. There are so many foods which clam to be richest source of antioxidants.

KEYWORDS: Antioxidants, ROS, Human health, free radicals.

INTRODUCTION

The oxygen which is essential for life, when reacted with other molecules generates free radicals or Reactive oxygen species to the system. These free radicals can be also introduced from hazardous environment. These free radicals when generated accumulate over a period, react with other molecules and denature them forming oxidative stress. This is a pathological condition which covers many diseases in its account. Oxidative stress is a deleterious process that can damage all cell structures.[1] The oxidative stress over time hastens aging process and many other degenerative disorders even altering DNA. The antioxidants are those which can scavenge them and repair those pathological conditions. Free radicals need pairs of electrons in order to be stable and they try to find molecules. Antioxidants stop free radical damage to molecules[2] by accepting or donating an electron to make it stable. Antioxidants are unique

in that they remain stable when they donate an electron. Antioxidants sources are often discussed in terms of their free radical scavenging abilities referring as "free radical scavenging activity" of antioxidants vary from one to other. Free radicals when produced in excess causes tissue injury. Free radicals are always found in human body implicating to oxidative stress leading to many pathological conditions. These pathological conditions including like cancer, atherosclerosis, malaria, rheumatoid arthritis and neurodegenerative diseases. Even when free radicals are in excess damage DNA. These free radicals accumulate in these underlying mechanisms of many pathological conditions. Antioxidants are the agents which fight with these free radicals. So, this is an important hour to study the importance of antioxidant enzymes. In this paper we discuss about the antioxidant enzymes, superoxide dismutase (SOD), glutathione peroxidase (GPx) and catalase (CAT).

SUPEROXIDE DISMUTASE (SOD)

Superoxide dismutase (SOD, EC 1.15.1.1) is an enzyme that alternately catalyzes the dismutation of the superoxide (O_2-) radical into either ordinary molecular oxygen (O_2) or hydrogen peroxide (H_2O_2). Superoxide is produced as a by-product of oxygen metabolism and, if not regulated, causes many types of cell damage[3] as causing mutations in DNA or attack enzymes that make amino acids and other essential molecules. SOD is an important antioxidant defence for scavenging superoxide radical in nearly all living cells exposed to oxygen. In plants SOD acts as antioxidant which in turn protects them from cellular damage by reactive oxygen species. Thus, SOD catalyzes the production of O_2 and H_2O_2 from superoxide (O_2-), which results in less harmful reactants. In some bacteria they produce SOD to protect them.[4] SOD plays a significant role in preventing Amyotrophic Lateral Sclerosis (ALS), which is a kind of illness that leads to death because it affects nervous system. SOD is also used for treatment of inflammatory diseases, burn injuries, prostate problems, arthritis, corneal ulcer, and reversing the long term effects of exposure to reactive oxygen species.

CATALASE (CAT)

CAT (EC 1.11.1.6) is a tetrameric enzyme consisting of four identical tetrahedrally arranged subunits of 60 kDa that contains a single ferriprotoporphyrin group per subunit, and has a molecular mass of about 240 kDa.[5] CAT reacts very efficiently with H_2O_2 to form water and molecular oxygen and with Hydrogen donors with peroxidase activity.

Catalase is a common enzyme found almost in all aerobic living organisms as plants, animals and bacteria which are exposed to oxygen. It catalyzes the decomposition of hydrogen

peroxide to water and oxygen.[6] Catalase is a very important enzyme in protecting the cell from oxidative damage by reactive oxygen species (ROS). Similarly, it has one of the highest turnover numbers of all enzymes; one catalase molecule can convert millions of hydrogen peroxide molecules to water and oxygen each second.[7] Hydrogen peroxide interferes with melanin which is a main role in greying of hair, as catalase decreases hydrogen peroxide cannot be broken down.

GLUTATHIONE PEROXIDASE (GPX)

The GPx (EC 1.11.1.19) contains a single selenocysteine selenocysteine (Sec) residue in each of the four identical subunits,[8] GPX (80 kDa) catalyses the reduction of hydro peroxides using GSH, thereby protecting against oxidative damage. The biochemical function of glutathione peroxidase is to reduce lipid hydroperoxides to their corresponding alcohols and to reduce free hydrogen peroxide to water. Glutathione metabolism is one of the most essential antioxidative defence mechanisms and also acts as immune system booster.

ANTI-OXIDANT RICH FOOD

Antioxidants are found in a vast range of foods including nuts, whole grains, some meat, poultry & fish and particularly in brightly-coloured fruits and vegetables. Some antioxidant rich foods are Citrus fruits, Berries, Tomatoes, Colourful vegetables, Walnuts, hazelnuts, brazil nuts, Tea, coffee and cocoa. It appears that the complex display of antioxidants present naturally in plants as well as those the body produces in reaction to stress may be more important.

CONCLUSION

Oxidative stress, caused by accumulation of free radicals, is a major causative factor for pathological conditions. Antioxidants are the boon for oxidative stress, so there is a need to take antioxidants rich food to attack these free radicals.

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