

Role of Endogenous Antioxidants in Body

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THE human body generates free radicals continuously as the inevitable byproduct of turning food into energy. In the process of life and death of a cell, free radicals play an important role. Atom is the smallest particle in the body and when atoms join together, they form molecules. Bodily tissues are formed when molecules join. Electrons, small electrically charged particles which circle around atoms act as a magnet to attract other atoms.

Free radicals lack the normal amount of electrons; therefore, they steal electrons from normal, healthy atoms. When free radicals steal the electrons from the atoms of the cells, this causes damage to the cells of the body. The bodily tissues are damaged by free radicals as they steal the electrons from the atoms that constitute the tissues. Antioxidants are molecules in cells that prevent free radicals from taking electrons, thereby protecting body tissues from free radical damage.

It is interesting to find the human body equipped with an in-built antioxidant system to prevent the loss caused due to free radicals. To protect the cells and organ systems of the body against free radicals, humans have evolved an extremely sophisticated and complex antioxidant protection system.

Antioxidants play a crucial role in our internal defence system protecting against harmful metabolites and other substances. Antioxidants are defined as compounds that inhibit or delay the oxidation of other molecules by inhibiting the initiation or propagation of oxidising chain reactions. They are also called as oxidation inhibitor. An antioxidant molecule can react with single free radical and is capable to neutralise free radical. Antioxidants act against free radicals to neutralise them from both endogenous and exogenous origins.

Antioxidants and Free Radicals

Antioxidants keep free radicals in check. The occurrence of oxidative damage to biological macromolecules caused by reactive oxygen species are prevented by antioxidants. The body has efficient protective mechanisms against reactive species to counteract their toxicity. The concentrations of these toxic agents remain at very low levels

under normal conditions due to the action of endogenous antioxidant systems and exogenous compounds provided by food.

The oxidative stress induced by free radicals is now believed to be a fundamental mechanism underlying a number of human diseases ranging from cardiovascular, neurologic to other degenerative disorders. Antioxidants are our crucial defence against free radical induced damage, and are critical for maintaining optimum health and wellbeing.

Antioxidants which are classified as endogenous or exogenous, are responsible for removal of free radicals, scavenging ROS or their precursors, inhibiting formation of ROS and binding metal ions needed for catalysis of ROS generation. Exogenous antioxi-

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dants also play a vital role to help the endogenous antioxidants to protect the body.

Endogenous Antioxidants Defence System

Through an elaborate endogenous antioxidant defence system, the cellular redox homeostasis is carefully maintained in the human body. When ROS levels rise and threaten the homeostatic processes of the human body, the endogenous antioxidants are activated. They also work together with exogenous antioxidants from diet to decrease levels of ROS.

The antioxidants that are produced by our own bodies are called endogenous antioxidants. They are not obtained from food sources and are highly potent and very powerful. By initiating cell regeneration from the inside, they repair all the damages caused by free radicals. High levels of antioxidants in the body are probably very beneficial. But it is really more important to make sure that our own body is producing enough of its own, endogenous antioxidants.

Endogenous Antioxidant Enzymes

The body's defence system against oxidative stress is sustained by several mechanisms comprising enzymatic and non-enzymatic antioxidants. The cells in eukaryotic organism contain powerful antioxidant enzymes.

Antioxidant enzymes such as CAT, SOD and GPx present a powerful array to prevent biological macromolecules from the deleterious effects of ROS and act as the first line defence antioxidants.

The three major antioxidant enzymes - (SOD) superoxide dismutases, (CAT) catalase and glutathione peroxidase (GPx) are the primary antioxidant enzymes which inactivate the ROS into intermediates.

These enzymes are components of an organism's mechanisms for combating oxidative stress which is generated in normal metabolism and which may also be a reaction in response to external stimuli. They attenuate the generation of reactive oxygen species by removing potential oxidants or by transferring ROS/RNS (reactive nitrogen species) into relatively stable compounds.

The activities of SOD, catalase (CAT) and GPx constitute a first line antioxidant defence system which plays a key and fundamental role in the total defence mechanisms and strategies in biological systems.

They serve as the primary line of defence in destroying free radicals and in protecting against oxidative stress. For such activity, these major antioxidant enzymes require micronutrient cofactors such as copper, manganese, zinc, selenium and iron. Studies say that an inadequate dietary intake of these trace minerals may also lead to low antioxidant activity.

Superoxide dismutase (SOD) is an important endogenous antioxidant enzyme which are proteins that contain copper and zinc, or manganese, iron, or nickel. They act as the first line defence system against ROS which scavenges superoxide radicals. Humans contain three forms of superoxide dismutase: SOD1 is located in the cytoplasm, SOD2 in the mitochondria, and SOD3 is extracellular.

Catalase (CAT) is a common, most efficient



CONTINUED ON P 64 ►

Exogenous antioxidants are Vitamins A, C, E

CONTINUED FROM P 63 ►

enzyme found cell. It is a tetramer of four polypeptide chains and contains four porphyrin heme groups which allow the enzyme to react with the hydrogen peroxide. Each catalase molecule can decompose millions of hydrogen peroxide molecules to water and oxygen in every second.

Glutathione peroxidase (GPx) is present in the cytoplasm of the cells and protects the cell against oxidative injury caused by H₂O₂ and it also prevents the formation of hydroxyl radical from H₂O₂. It consists of four protein subunits; each of which contains one atom of the element selenium at its active site. Glutathione is a central tissue antioxidant and the major chemical in the body to detoxify cells. It discourages cells from oxidative stress, a toxic accumulation of too much reactive oxygen in cells. The usual primary source of glutathione is diet.

Beneficial Effects of Antioxidant Enzymes

One of the most important benefits of antioxidant enzymes are that they are highly potent in neutralising the free radicals even before they attack cellular components. They do this by first reducing the energy of the free radicals by the act of giving up some of their electrons for its use. Antioxidant enzymes also interrupt with the oxidising chain reaction to minimise the damage caused by free radicals.

Studies show a substantial link between free radicals and more than 60 different health conditions, including the ageing process, cancer, diabetes, Alzheimer's disease, strokes, heart attacks and atherosclerosis. Our body's potential to reducing the risk of free radical related health problems is made more palpable, by reducing exposure

to free radicals and increasing the intake of antioxidant enzyme rich foods or antioxidant enzyme supplements. Antioxidant enzymes are, therefore, absolutely critical for maintaining optimal cellular and systemic health and well being.

Research has concluded that increasing endogenous antioxidant levels by supplying pro-oxidants may be a better approach to therapeutics and disease prevention than consuming large doses of dietary antioxidants.

The best strategy to enhance endogenous antioxidant levels in the body is by healthy lifestyle, some pro-oxidants, including the polyunsaturated fat, exercise, and moderate alcohol consumption.

Ways to Improve Antioxidant Status

The whole body is protected against oxidative stress when there is a high antioxidant status. It is therefore very important to incorporate into one's diet a plentiful variety of fruits and vegetables. These fruits and vegetables supply vitamin and mineral antioxidants in reasonable amounts, and phytonutrients in them stimulate the production of endogenous antioxidants. By providing body with adequate nutrition, it will have the required tools to create a solid antioxidant defence.

Increased intake of fruits and vegetables lowers cell damage, oxidative stress, DNA damage, malignant transformation rate. It has also been seen epidemiologically, results of lowered incidence of certain types of cancer and degenerative diseases, such as ischemic heart disease and cataract.

The body's production of endogenous antioxidants declines with age. The glutathione levels decline about 10-15% per

decade as one grows older. One of the strong factors in contributing premature ageing and degenerative diseases are due to the decrease in endogenous antioxidants. With increased intake of exogenous antioxidants from fruit and vegetables it helps support the endogenous antioxidative defence.

Some of the main exogenous antioxidants are Vitamins A, C, E, beta carotene, lycopene, lutein, selenium, lutein, manganese and zeaxanthin.

Flavonoids, flavones, catechins, polyphenols, and phytoestrogens are all types of antioxidants and phytonutrients, which are all found in plant-based foods.

Flavonoids, a group of natural substances with variable phenolic structures, are found in fruits, vegetables, grains, bark, roots, stems, flowers, tea and wine. These natural plant antioxidants are well known for their beneficial effects on health due to their antioxidative, anti-inflammatory, anti-mutagenic and anti-carcinogenic properties coupled with their capacity to modulate key cellular enzyme function.

It is important to have a varied diet, as each antioxidant serves a different function and is not interchangeable with another. Clinical studies imply that eating a diet rich in fruits, vegetables, whole grains, legumes, and Omega-3 fatty acids can help humans in disease prevention. Foods that are particularly high in antioxidants are often referred to as a "superfood" or "functional food."

Foods with rich, vibrant colours often contain the most antioxidants. Some of the best foods that are good sources of antioxidants are spinach, lentils, broccoli, apples, blueberries. ○

(The author is a leading pharmaceutical consultant)

It is used in marinade of the meat and fish

CONTINUED FROM P 62 ►

One teaspoon vinegar can be added to mashed potato to keep potatoes white.

Add 1 teaspoon of vinegar in water in boiling of ham for purpose of improving the flavour. It is also used in marinade of the meat, fish and poultry for tenderisation.

Nutritional Benefits

It is good for controlling the blood sugar spikes and increase good HDL cholesterol levels. It is also used in weight loss. Different types of vinegar have different health benefits.

Company/ Brand Supplying Vinegar in India
Abbies, Adira, American Garden, Apollo Life, Bison, Borges, Bragg, By Nature, Chings,

Colavita, De Nigris, Del Monte, Double Horse, English Garden, FunFoods, Habit, N2H, Naturally Yours, Neo Foods, Nutriwish, Patanjali, Pietro Coricelli, Snacky, True Elements and Weikfield. ○

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