free-radicals

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Free-Radicals: Publications and Research from SwissMixIt

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PDF Version of the webpage (first pages)

Free Radicals Botanical Information

Free radicals and other oxidants have gained importance in the field of biology due to their central role in various physiological conditions as well as their impli- cation in a diverse range of diseases. The free radicals, both the reactive oxygen species (ROS) and reactive nitrogen species (RNS), are derived from both endogenous sources (mitochondria, peroxisomes, endoplasmic reticulum, phagocytic cells etc.) and exogenous sources (pollution, alcohol, tobacco smoke, heavy metals, transition metals, industrial solvents, pesticides, certain drugs like halothane, paracetamol, and radiation). Free radicals, Reactive oxygen species (ROS), Reactive nitrogen species (RNS), free radical, antioxidants, beneficial effects, deleterious effects, oxidative stress, diseases, health, atherosclerosis, DNA damage, flavonoids, free radicals, 8-hydroxydeoxyguanosine, isoprostanes, lipid peroxidation, oxidative protein damage, oxidative stress, phytochemicals,Molecular oxygen, Reactive oxygen species, Reactive secondary sequence, Polymerization, Lipid peroxidation, Membrane fluidity, Free-radical inhibitor

Keywords: Free radicals, Reactive oxygen species (ROS), Reactive nitrogen species (RNS), free radical, antioxidants, beneficial effects, deleterious effects, oxidative stress, diseases, health, atherosclerosis, DNA damage, flavonoids, free radicals, 8-hydroxydeoxyguanosine, isoprostanes, lipid peroxidation, oxidative protein damage, oxidative stress, phytochemicals,Molecular oxygen, Reactive oxygen species, Reactive secondary sequence, Polymerization, Lipid peroxidation, Membrane fluidity, Free-radical inhibitor

Description and Research Abstract: Free radicals and other oxidants have gained importance in the field of biology due to their central role in various physiological conditions as well as their impli- cation in a diverse range of diseases. The free radicals, both the reactive oxygen species (ROS) and reactive nitrogen species (RNS), are derived from both endogenous sources (mitochondria, peroxisomes, endoplasmic reticulum, phagocytic cells etc.) and exogenous sources (pollution, alcohol, tobacco smoke, heavy metals, transition metals, industrial solvents, pesticides, certain drugs like halothane, paracetamol, and radiation).

Free radicals and oxidants play a dual role as both toxic and beneficial compounds, since they can be either harmful or helpful to the body. They are produced either from normal cell metabolisms in situ or from external sources (pollution, cigarette smoke, radiation, medication). When an overload of free radicals cannot gradually be destroyed, their accumulation in the body generates a phenomenon called oxidative stress. The human body has several mechanisms to counteract oxidative stress by producing antioxidants, which are either naturally produced in situ, or externally supplied through foods and/or supplements.

Alcohol promotes the generation of ROS and/or interferes with the body's normal defense mechanisms against these compounds through numerous processes, particularly in the liver. For example, alcohol breakdown in the liver results in the formation of molecules whose further metabolism in the cell leads to ROS production.

Plants contain significant amount of polyphenols comprising of different groups such as flavonoids and phenolic acids which are further divided into subgroups. These polyphenols are known to prevent certain disease conditions by their ability to scavenge active free radicals species. Hence, the researchers today are emphasizing on evaluation of free radical scavenging activity of various plants parts and foods.

The free radical theory of aging has provided a theoretical framework for an enormous amount of work leading to significant advances in our understanding of aging. Up to the turn of the century, the theory received abundant support from observations coming from fields as far apart as comparative physiology or molecular biology. Recent advances: Work from many laboratories supports the theory, for instance showing that overexpression of antioxidant enzymes results in increases in life-span.

This minimally invasive methodology enabled a quantitative evaluation of potent antioxidant activity in situ in the stratum corneum reflecting real-life skin conditions and confirming the benefits of the topical application of a product containing 3 antioxidants in the prevention of UVA-induced oxidative damage.

Free radicals are an outcome of various metabolic activities and their excess production leads to many diseases. Therefore, it is necessary to neutralize excess free radicals. The different extracts of S. wallichii scavenged different free radicals efficiently due to the presence of flavonoids and polyphenols and may be helpful in free radical-induced diseases.

In conclusion, cornsilk contained high polyphenol components with strong free radical scavenging activity thus could be considered as potential source of natural antioxidant.

Free radicals and other reactive oxygen species (ROS) are constantly formed in the human body. Free-radical mechanisms have been implicated in the pathology of several human diseases, including cancer, atherosclerosis, malaria, and rheumatoid arthritis and neurodegenerative diseases. Antioxidant defenses to remove O2 and H2O2 exist.

Human skin is constantly directly exposed to the air, solar radiation, environmental pollutants, or other mechanical and chemical insults, which are capable of inducing the generation of free radicals as well as reactive oxygen species (ROS) of our own metabolism. Extrinsic skin damage develops due to several factors: ionizing radiation, severe physical and psychological stress, alcohol intake, poor nutrition, overeating, environmental pollution, and exposure to UV radiation (UVR). It is estimated that among all these environmental factors, UVR contributes up to 80%. UV-induced generation of ROS in the skin develops oxidative stress, when their formation exceeds the antioxidant defence ability of the target cell. The only protection of our skin is in its endogenous protection (melanin and enzymatic antioxidants) and antioxidants we consume from the food (vitamin A, C, E, etc.). The most important strategy to reduce the risk of sun UVR damage is to avoid the sun exposure and the use of sunscreens. The next step is the use of exogenous antioxidants orally or by topical application and interventions in preventing oxidative stress and in enhanced DNA repair.

Living cells continually generate free radicals or reactive oxygen species (ROS) through the respiratory chain during energetic metabolism. ROS can either be harmful or play important physiological roles in our body. Besides being produced during normal cell metabolism there are numerous exogenous factors, such as irradiation by UV light, X-rays, gamma-rays, and atmospheric pollutants which may lead to generation of ROS. Human body has various intrinsic mechanisms to counteract oxidative stress by producing antioxidants, or through externally derived foods and/or supplements.

Oxygen is necessary for energy production via the electron transport chain in living organisms, a mechanism by which energy (ATP) is released to enable the cell carry out its normal physiological functions. This is attributed to its high redox potential which makes it a brilliant oxidizing agent capable of easily accepting electrons from reduced substrates. This contradictory effect of oxygen in living organisms necessitated the evolution of antioxidant system to protect against over oxidation and combat reactive oxygen species (ROS). The mitochondria are the most vital source of ROS production. Antioxidants primarily function to balance out free radicals generated during metabolic processes including during mechanisms involved in protecting the gut from inflammation and injury. Further, at adequate free-radical concentrations a reactive crosslinking unsaturated aldehyde lipid breakdown product can significantly support free-radical polymerization of lipid oils into rubbery gel-like solids and eventually even produce a crystalline lipid peroxidation with the double bond of O2. Most importantly, free-radical inhibitor hydroquinone intended for medical treatments in much pathology such as cancer, atherosclerosis, diabetes, infection/inflammation and also ageing has proven extremely effective in sequestering free radicals to prevent chain-growth reactive secondary sequence polymerization.

Although free radicals are traditionally regarded as harmful by-products of aerobic cellular metabolism, this view has recently essentially changed and it is now evident that production of reactive oxygen species (ROS) and reactive nitrogen species (RNS) are strongly regulated processes that play central roles in most cell signaling. During physiological and pathophysiology processes, ROS and RNS can act as secondary messengers and control gene expression, apoptosis, cell growth, cell cycle, cell adhesion, chemotaxis, protein-protein interactions and enzymatic functions, Ca2 and redox homeostasis, to name but a few functions.

It appears, however, that antioxidant supplements do not provide adequate protection against oxidative stress and do not lead to an increase of the lifespan. Some current studies revealed that antioxidant treatment has either no effect or can even enhance mortality.

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