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Antioxidants and Their Relationship with Aging

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Abstract
Aging is a degenerative, biological, time-dependent, universally conserved process thus designed as one of the highest known risk factors for morbidity and mortality. Every individual has its own aging mechanisms as both environmental conditions (75%) and genetics (25%) account for aging. Several theories have been proposed until now but not even a single theory solves this mystery. There are still some queries un-answered to the scientific community regarding mechanisms behind aging. Exogenous supplementation with dietary antioxidants and/or skin pre-treatment with antioxidant-based lotions before sun exposure might be a winning strategy against age-related skin pathologies.
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I. Introduction

Antioxidants Antioxidants are substances, which inhibit or delay oxidation of a substrate while present in minute amounts. Endogenous antioxidant defences are both non-enzymatic (eg, uric acid, glutathione, bilirubin, thiols, albumin, and nutritional factors, including vitamins and phenols) and enzymatic (eg, the superoxide dismutases, the glutathione peroxidases [GSHPx], and catalase). In the normal subject the endogenous antioxidant defences balance the reactive oxygen species production, but for the above-mentioned 1% daily leak. The most important source of antioxidants is provided by nutrition, many belonging to the phenol family.

Nutritional antioxidants act through different mechanisms and in different compartments, but are mainly free radical scavengers: 1) they directly neutralise free radicals, 2) they reduce the peroxide concentrations and repair oxidized membranes, 3) they quench iron to decrease reactive oxygen species production, 4) via lipid metabolism, short-chain free fatty acids and cholesteryl esters neutralise reactive oxygen species ***(Berger et al., 2005).***

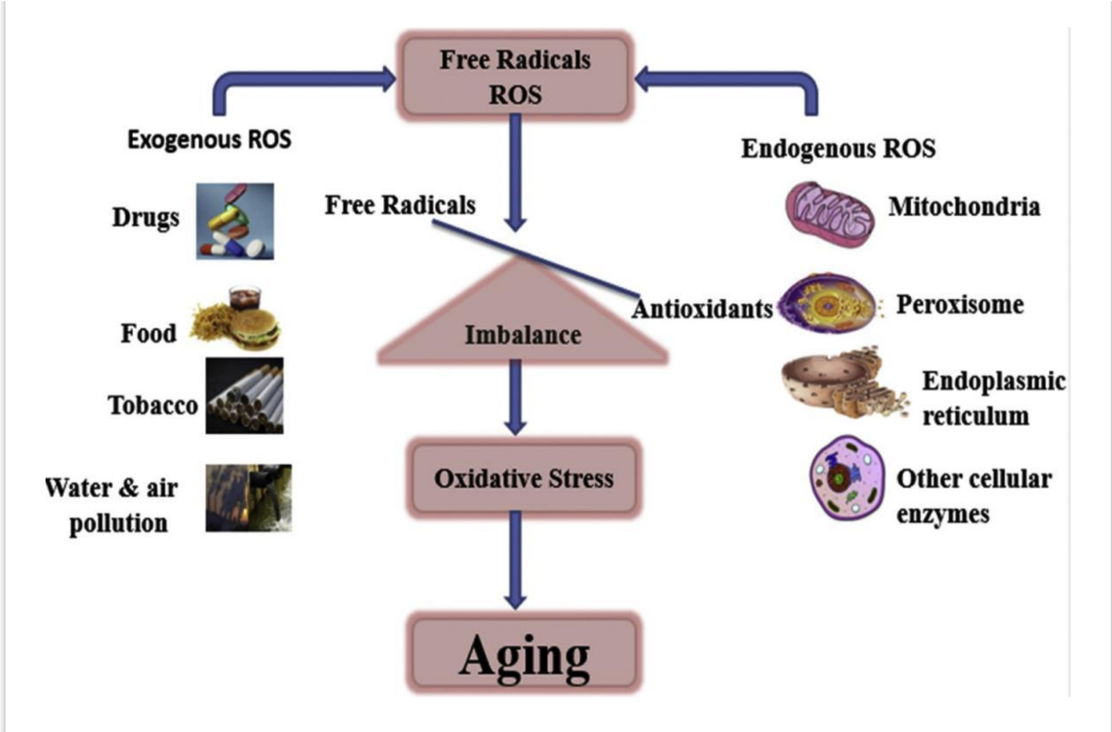
Vitamin C is the major water-soluble antioxidant and acts as first defence against free radicals in whole blood and plasma. It is a powerful inhibitor of lipid peroxidation and regenerates vitamin E in lipoproteins and membranes. A strong inverse association has been shown between plasma ascorbic acid and isoprostanes **(Block *et al.*, 2002).**

The body antioxidant defence can be approximated by measuring antioxidant plasma levels (micro nutrients, enzymes, and other antioxidant), keeping in mind that the circulating compartment only reflects the flow between organs and tissues. The tissue levels of the various antioxidants remains limited to research protocols as tissue biopsies are required.

Aging is a biological, degenerative process. It progresses slowly and is much more complicated to be measured quantitatively. Aging results in functional decline of organisms such as physiological functions with time and hence chances of death and disease rate are increased ***(Lee and Wei, 2012; Labat-Robert and Robert, 2015; Kauppila et al., 2017).***

Aging theories Indeed, above 300 theories including many mechanistic and evolutionary theories have been proposed by the scientific community to explain why and how living organisms age and the driving force behind aging, but not even a single theory has been proved to be universally applicative **(Pomatto and Davies, 2018).**

Production of ROS During the cellular redox process, byproducts are generally produced such as RONS (reactive nitrogen species) as well as ROS **(Pham-Huy *et al*., 2008).** These products define the radical and non-radical active compounds of nitrogen and oxygen **(Powers *et al*., 2011).**



Endogenous antioxidants

Antioxidant can be divided into enzymatic and nonenzymatic ROS scavengers on the bases of their biological function. The main enzymatic antioxidants are catalase (CAT), superoxide dismutase (SOD), glutathione peroxidase, glutathione reductase, glutamyl Transpeptidase (GT). Non-enzymatic antioxidants are dietary compounds including minerals (selenium, zinc) vitamins (C, E) and also uric acid, ubiquinol, tocopherol, retinol and glutathione **(Momtaz and Abdollahi., 2012).** Both non-enzymatic and enzymatic antioxidants function in different cellular compartments and against different oxidative species, hence they are complementary to each other. Additionally, they perform their functions with exogenous antioxidant systems in a synergistic way **(Petruk *et al.*, 2018).** Many fresh and raw foods contain minerals or essential vitamins. Collectively, these nature-derived molecules are known as "phytonutrients" **(Bjørklund and Chirumbolo., 2017).**

Exogenous anti-oxidants

Human body lacks non-enzymatic anti-oxidants and hardly produces them, hence there are exogenous antioxidants. There are three categories of exogenous non-enzymatic antioxidants: i) mineral elements such as selenium ii) nutritional antioxidants like carotenoids, vitamin E and vitamin C and iii) natural antioxidants: obtained from natural resources commonly known as phytochemicals/phytonutrients **(Santos *et al.*, 2018).**

Environmental and Xenobiotic Agents Involved in Skin Aging

Aging is a complex biological process, as it induces progressive deterioration of anatomical structures and of the physiological functions of the organs. The skin is the outermost barrier of the body and the biggest organ, and its changes are among the most visible signs of aging. Indeed, with aging, the skin loses some of its properties, such as elasticity, thickness, and colour. The normal cellular oxidative metabolism can generate different by-products responsible for molecular damage, thus contributing to skin aging (intrinsic aging). However, it has been reported that up to 80–90% of skin aging is due to environmental and xenobiotic agents (extrinsic aging).

The effects of UV radiation on the skin have received increasing attention as it is the major environmental trigger affecting the structure of the skin **(Lee et al., 2018).**

Antioxidants as Antagonists of ROS in Skin Disorders

The aerobic world is characterized by high levels of toxic oxygen by-products. To survive in this adverse environment, the organism has evolved antioxidant systems to protect itself. However, antioxidants are also characterized by the ability to form a new, more stable radical, through inter molecular hydrogen bonding and further oxidation. In addition, antioxidants can regulate gene expression inducing the translocation of the nuclear factor-erythroid 2-related factor 2 (Nrf-2) from the cytosol to the nucleus, upon dissociation from its inhibitor, Kelch-like erythroid cell-derived protein 1 (Keap-1).**(Khlebnikov *et al.*2017)**

Fruits and Vegetables as Powerful Sources of Antiaging Antioxidants

Exogenous supplementation with dietary antioxidants and/or skin pre-treatment with antioxidant-based lotions before sun exposure might be a winning strategy against age-related skin oxidative damage. Indeed, a regular intake of vitamins, polyunsaturated fatty acids, and polyphenols from plant sources has been shown to contribute to the prevention of age-related diseases. The search for effective natural compounds able to protect against the deleterious effects of photo aging has been intensified in recent years. Indeed, the list of molecules with antiaging potential extracted from different parts of a number of plant species is continuously growing.**(Silke K. Schagen *et al.*, 2012)**

II. Conclusions

We all are aware of the fact that a high mortality and morbidity rate are attributed to aging. Aging is a global issue as the number of centenarians increasing worldwide. We cannot deny the reality of being aged but we can convert this time-dependent and natural process of aging, into a healthy aging process by taking certain preventive measures, because the number of healthy centenarians is not very high

Skin photo aging is a consequence of the oxidative stress generated upon exposure to UV radiation. However, the skin is normally protected from the negative effects of oxidative stress by endogenous antioxidant systems, which, unfortunately, undergo a progressive decline during aging. Several lines of evidence support the hypothesis that secondary metabolites from plants act as natural antioxidants able to decrease or retard the development and progression of life style-related diseases.

The intake of dietary antioxidants plays a fundamental role in the protection against oxidative injury; therefore, a correct diet is crucial to extend lifespan.

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