


Chapter 4


Environmental Exposure and Oxidative Stress: Effects on Human Health

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ABSTRACT

Exposure to environmental pollutants/toxins has progressively been identified as a major cause of different health concerns. Air pollution, occupational and radiation exposures, and agricultural chemicals are significant environmental factors contributing to oxidative stress (OS) and adverse health outcomes. Air pollution (particulate matter/toxic gases) is worsening respiratory and cardiovascular diseases. The occupational exposures to harmful substances can create chronic oxidative conditions which affects overall health. Radiation exposures (medical procedures /

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environmental sources) and agricultural chemicals cause the cellular damage, increasing the risk of cancer, affecting endocrine and neurological functions. Overall impact of these exposures is required rigorous monitoring and regulation to mitigate health risks. Addressing these environmental challenges is essential in protecting health and promoting public awareness to reduce harmful exposures and improve overall well-being.

1. INTRODUCTION:

Oxidative stress, a phenomenon of considerable importance within the realm of cellular biology, manifests within human cells primarily because of an imbalance that occurs between the production of reactive species and the capacity of antioxidant defenses to neutralize these potentially harmful entities, thereby contributing significantly to the pathogenesis of a myriad of diseases that afflict the population. The primary sources of this oxidative stress can be traced back to a variety of environmental factors, lifestyle choices, and intrinsic metabolic processes, which collectively culminate in chronic oxidative stress and, as a result, lead to extensive cellular damage that may compromise overall health and well-being. The exposure to a plethora of harmful chemicals, the consumption of a nutritionally poor diet, coupled with a sedentary lifestyle, can significantly elevate the levels of reactive species in the body, thus leading to an exacerbation of oxidative stress, as per the reports published (J Biochem Mol Toxicol, 2023). Within the complex framework of normal metabolic processes, free radicals, notably including reactive oxygen species (ROS), are generated. However, it is critical to recognize that these molecules can become deleterious to cellular integrity when they are produced in excessive quantities (Elsevier eBooks, 2023). Increased oxidative stress can affect the normal physiology of the body by affecting the essential biomolecules such as DNA, proteins, and lipids, which in turn disrupts various critical cellular functions and intricate signaling pathways within the organism, potentially leading to the initiation and progression of a multitude of diseases including, but not limited to, cancer, diabetes, and an array of neurodegenerative disorders, as evidenced by the findings (Curr Mol Med, 2023) and supported by the research titled “Free Radicals, Oxidative Stress-Related Diseases and Antioxidant Supplementation” published in 2022. The observation of increased concentrations of specific markers, such as malondialdehyde (MDA), serves as a significant indicator of oxidative damage and has been shown to correlate with the presence and severity of various pathological conditions (J Cell Physiol, 2023). While it is well-established that oxidative stress constitutes a major contributing factor in the development and exacerbation of numerous diseases. It is also important to acknowledge that certain studies have proposed that low levels of

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