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Editorial

Role of Genetics: A nexus for Oxidative Stress and Infection

Reactive oxygen species (ROS) are formed continuously within the body and cause oxidative stress if the production of ROS exceeds the body's capability to counteract their action with antioxidant systems. It is also highlighted that oxidative stress (OS) and its related diseases are partly determined by genetic factors. Oxidative stress (OS) develops due to exposure to sources of active oxygen, unhealthy diet, habits, and heredity. It is involved in the advancement of many diseases like heart diseases, diseases affecting the brain, cancer, diabetes, and male impotence due to its disruptive effect on cellular structures including DNA, proteins, and lecithin.

Infections caused by infectious agents can lead to acute and chronic diseases. In chronic infections, production of reactive oxygen (ROS) and nitrogen species (RNS) are often triggered, which are linked to various pathologies and serious conditions such as cancer, autoimmune diseases, and organ dysfunctions. These infections induce tissue damage either (viral) by triggering anti-inflammatory responses or (bacterial) by altering metabolic pathways which lead to various conditions such as liver fibrosis, cirrhosis, and neurodegenerative diseases. Despite extensive research, the full impact of many infectious agents on host redox systems remains insufficiently understood, with existing studies often showing conflicting results.

Polymorphisms in some of the antioxidant enzymes (such as SOD, GPx, CAT) and the modulatory signaling pathways (NRF2/KEAP1) also contribute to one's genetic predisposition to OS-associated diseases. Novel techniques in high through-put omics studies, as well as exciting novel therapies like gene editing and RNA based medicines give hope in fighting diseases related to oxidative stress. It is emphasized that the role of genetics, environment, and other factors that may relate to oxidative stress should be utilized for creating proper therapeutic approaches, personalization of medicine, and modifying people's well-being for the betterment. Appreciation of how oxidative stress interacts with genetics is crucial for the decoding of disease etiology, biomarker discovery and differential gene expression for targeted therapy of diseases that have impaired oxidative stress.

The intricate relationship between genetic predispositions and oxidative stress could be associated with the pathogenesis of various conditions. Genetic variations in prooxidant and antioxidant genes affect oxidative stress levels. While genetic assessments could help in identification of individual risks for oxidative stress-related conditions. Biomarkers offer insight into actual oxidative stress levels, crucial for effective management. Such approaches will aid in early intervention and personalized treatments. Further research is needed to optimize these approaches and understand their effectiveness in managing oxidative stress-related diseases.

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