

Oxidative Stress: Mechanism, Causes and Impact on Human Health

Muhammad Ail Shaik*

Department of Chemistry, Aga Khan University, Karachi, Pakistan

DESCRIPTION

In recent years, oxidative stress has emerged as a crucial concept in understanding the underlying mechanisms of various health disorders. This article aims to shed light on the significance of oxidative stress, its impact on human health, and the potential strategies to combat its detrimental effects.

Oxidative stress occurs when there is an imbalance between the production of Reactive Oxygen Species (ROS) and the body's antioxidant defense mechanisms. ROS are highly reactive molecules generated as byproducts of normal cellular metabolism. Under normal conditions, the body can manage and neutralize these ROS through antioxidant enzymes and molecules. However, when the balance is disrupted, excessive ROS production overwhelms the antioxidant defenses, leading to oxidative stress.

Mechanisms and impact on health

Oxidative stress is known to damage lipids, proteins and DNA, resulting in cellular dysfunction and contributing to the development of various health disorders. It plays a critical role in the pathogenesis of conditions such as cardiovascular diseases, neurodegenerative disorders, cancer, diabetes and aging. Oxidative stress-induced damage to cells and tissues can trigger chronic inflammation, DNA mutations and impaired cellular signaling pathways, leading to the onset and progression of these diseases.

Environmental factors and oxidative stress

Several environmental factors contribute to increased oxidative stress levels in the body. Exposure to air pollution, cigarette smoke, pesticides, heavy metals and certain medications can generate excessive ROS and overwhelm the antioxidant defense system. Lifestyle factors, such as poor diet, sedentary behavior and chronic psychological stress, also play a significant role in promoting oxidative stress. Furthermore, chronic diseases themselves can create a state of increased oxidative stress, forming a vicious cycle.

Antioxidant defense and strategies for protection

The body possesses a complex antioxidant defense system to counteract the damaging effects of oxidative stress. Antioxidants scavenge and neutralize ROS, reducing their harmful impact on cells. Dietary antioxidants, including vitamins C and E, carotenoids, flavonoids and polyphenols, are obtained from fruits, vegetables, and other plant-based sources. Regular physical exercise, stress reduction techniques and maintaining a balanced diet rich in antioxidants are essential strategies to enhance the body's antioxidant defenses.

Therapeutic approaches to combat oxidative stress

Given the pivotal role of oxidative stress in various diseases, therapeutic interventions targeting oxidative stress have gained attention. Antioxidant supplements have been studied for their potential protective effects, but the results have been mixed and caution is warranted. Novel therapeutic approaches focusing on modulating the antioxidant defense system or targeting specific ROS-generating pathways are being explored. Additionally, lifestyle modifications, including regular exercise, stress reduction techniques and a nutrient-rich diet, can significantly contribute to reducing oxidative stress levels.

Future directions

Oxidative stress continues to be a topic of extensive research as scientists strive to unravel its complexities and develop effective strategies for intervention. Further studies are needed to better understand the precise mechanisms by which oxidative stress contributes to disease development and progression. Additionally, identifying biomarkers of oxidative stress and personalized approaches to manage and prevent oxidative stress-related diseases hold promise for the future.

CONCLUSION

Oxidative stress stands as a key player in the pathogenesis of various health disorders. Understanding its impact on cellular function and exploring effective strategies to mitigate its harmful effects is crucial for improving human health and well-being. By

Correspondence to: Muhammad Ail Shaik, Department of Chemistry, Aga Khan University, Karachi, Pakistan, E-mail: Shaik.ail@gmail.com

Received: 25-May-2023, Manuscript No. JPE-23-24798; **Editor assigned:** 29-May-2023, PreQC No. JPE-23-24798 (PQ); **Reviewed:** 12-Jun-2023, QC No. JPE-23-24798; **Revised:** 20-Jun-2023, Manuscript No. JPE-23-24798 (R); **Published:** 28-Jun-2023, DOI: 10.35248/2375-4397.23.11.368

Citation: Ail Shaik M (2023) Oxidative Stress: Mechanism, Causes and Impact on Human Health. J Pollut Eff Cont. 11:368.

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adopting a holistic approach that includes lifestyle modifications, dietary interventions and targeted therapeutic

strategies, we can address the hidden culprit of oxidative stress and pave the way for a healthier future.