

Antioxidants and Chronic Disease: The Biochemical Shield of Public Health

In the modern world, chronic diseases such as cancer, heart disease, and ageing-related disorders continue to be major public health concerns. A growing body of research highlights the role of antioxidants in combating these diseases by neutralising free radicals—harmful molecules that cause oxidative stress in the body. Antioxidants, whether derived from food or supplements, act as a protective shield at the molecular level, helping to prevent cellular damage and promoting overall health.

Molecular Mechanism of Antioxidants

Free radicals are byproducts of normal metabolic processes, and their levels can also be influenced by external factors such as pollution, smoking, and UV radiation. These highly reactive molecules can damage cells, proteins, lipids, and DNA, leading to the onset of diseases like cancer and heart disease. Antioxidants counteract this damage by donating electrons to free radicals, thus stabilising them and preventing the harmful chain reactions that typically follow. Vitamins such as C and E, along with plant compounds like polyphenols, are well-known antioxidants that perform this crucial function (Halliwell & Gutteridge, 2007). By scavenging free radicals, antioxidants maintain cellular integrity and reduce the risk of chronic disease development.

Antioxidants in Disease Prevention

The protective role of antioxidants is especially significant in cancer and heart disease. Oxidative stress has been implicated in DNA mutations, a key factor in cancer initiation. By reducing oxidative damage to cellular structures, antioxidants help lower the risk of cancer development (Singh et al., 2009). Similarly, cardiovascular diseases are closely linked to oxidative damage in blood vessels and lipid oxidation, which accelerates plaque formation and narrows arteries. Antioxidants, particularly those found in flavonoid-rich foods such as berries and dark chocolate, can help prevent the oxidation of low-density lipoprotein (LDL) cholesterol, thereby reducing the risk of heart disease (Cai & Harrison, 2000).



Antioxidants and Ageing

Ageing is another process influenced by oxidative stress. Over time, the body's ability to manage free radicals diminishes, leading to cumulative cellular damage and the signs of ageing. Antioxidants are often included in anti-ageing formulations due to their ability to reduce oxidative damage to cells, tissues, and organs, helping to slow the ageing process (Finkel & Holbrook, 2000). The consumption of antioxidant-rich foods can contribute to maintaining vitality and reducing the effects of ageing-related diseases.

Antioxidants play a vital role in preventing and managing chronic diseases such as cancer, heart disease, and age-related disorders. By incorporating antioxidant-rich foods into our diets, we can strengthen our body's natural defence mechanisms against oxidative stress and support long-term health.



PAVIT LAUNGANI

CITATIONS

DiMasi, J. A., Grabowski, H. G., & Hansen, R. W. (2016). Innovation in the pharmaceutical industry: New estimates of R&D costs. *Journal of Health Economics*, 47, 20-33.

Ferreira, L. G., dos Santos, R. N., Oliva, G., & Andricopulo, A. D. (2015). Molecular docking and structure-based drug design strategies. *Molecules*, 20(7), 13384-13421.

Federal Trade Commission. (2010). Pay-for-Delay: How Drug Company Pay-Offs Cost Consumers Billions.

FTC. (2023). Statement on Challenging Improper Orange Book Patent Listings.

Hughes, J. P., Rees, S., Kalindjian, S. B., & Philpott, K. L. (2011). Principles of early drug discovery. *British Journal of Pharmacology*, 162(6), 1239–1249.

I-MAK. (2022). Overpatented, Overpriced: Special Report on Humira.

IQVIA Institute for Human Data Science. (2020). Medicine Use and Spending in the U.S.

Médecins Sans Frontières (MSF). (2018). Untangling the Web of Antiretroviral Price Reductions.

OpenSecrets. (2023). Pharmaceutical/Health Product Industry Profile.

Schneider, G., & Clark, D. E. (2019). Automated De Novo Drug Design: Are We Nearly There Yet? *Angewandte Chemie International Edition*, 58(32), 10792–10803.

U.S. Congress. (2022). REMEDY Act: Reforming Evergreening and Monopoly Extension by Drugmakers Act.