Acta Scientific NUTRITIONAL HEALTH (ISSN:2582-1423)

Volume 6 Issue 3 March 2022

Short Communication

Take Another Look at Antioxidants

Leonard W Heflich*

Innovation for Success, LLC, USA

***Corresponding Author:** Leonard W Heflich, Innovation for Success, USA.

DOI: 10.31080/ASNH.2022.06.1006

Received: January 27, 2022

Published: February 11, 2022

© All rights are reserved by **Leonard W Heflich.**

Antioxidants are molecules that are capable of donating an electron or accepting a proton from an unstable free radical molecule. Free radicals have an extra unpaired electron, making them very unstable, highly reactive and therefore dangerous. Early forms of life had to develop a mechanism for neutralizing free radicals in order to avoid the damage they cause. Studies of early bacteria have discovered the presence of antioxidants at least 2.5 billion years ago. Exposure to atmospheric oxygen and sunlight would not be possible without antioxidants to neutralize the free radicals produced. Anerobic bacteria never learned the trick and even today must hide underground or deep in the ocean where sunlight and oxygen cannot reach. The first organisms to produce an effective antioxidant, melatonin, were purple non-sulfurous bacteria, which later were incorporated into eukaryotic cells as mitochondria and chloroplasts [1,2]. Plants, fungi and animals cannot tolerate exposure to oxygen or sunlight without sufficient antioxidants to neutralize the highly reactive free radical molecules that are produced as a byproduct of respiration and exposure to UV radiation [3].

Life solved this challenge by converting tryptophan to melatonin via serotonin [4]. Although mainly known for its role in regulating circadian cycles and sleep, melatonin is versatile and involved in every function of the body. It is an amphipathic and very small molecule, allowing it to enter every cell compartment, where it acts as an electron donor to neutralize free radical molecules. This initiates a cascade of antioxidant events, amplifying its capability to neutralize free radicals [5]. Melatonin is so important that cells have specific sites (MT-1 and MT-2) that bind melatonin [6]. The bound melatonin on epithelial cells provides protection from free radical damage caused by UV radiation from the sun [7]. Melatonin is produced in humans in the pineal gland, but far more is produced in the mitochondria.

There are dozens of antioxidant molecules produced in plants and animals. In humans, the most important endogenous antioxidants include glutathione, melatonin, superoxide dismutase, catalase, and uric acid. Exogenous antioxidants ingested in food include Vitamin C, Vitamin E, selenium, zinc, lutein, astaxanthin, plant flavonoids and many more. Interestingly, the endogenous and exogenous antioxidants function cooperatively and synergistically [8]. Unfortunately, there are factors that reduce the production of endogenous antioxidants including age, disease, and elevated blood sugar. At the same time, there are factors that increase the burden of free radical molecules in the body including stress, air pollution, cigarette smoke, UV radiation, cosmic radiation, X-Rays and certain toxic materials [9].

The result of insufficient antioxidants, both produced endogenously in the body and taken in food exogenously, in combination with elevated levels of free radicals, is a condition of oxidative stress. There are many consequences of oxidative stress on the body, including chronic inflammation, damage to cellular components such as enzymes, lipids and DNA. The ultimate result of the accumulation of this damage over decades is aging, disease, cancer and death [10].

In 1988 Gerald Reaven proposed that many of the diseases common in Western society were related and due to a common set of root causes. He called it the Metabolic Syndrome [11]. Others before him had made a similar observation that diabetes, heart disease, hypertension, cancer and perhaps some autoimmune diseases were caused by chronic overeating and obesity. Chronic overeating, as is now common in Western society, may not result in obesity, but does upset the function of the liver in what is known as non-alcoholic fatty liver disease [12]. The excess fat stored in the liver and adipose tissue produce inflammatory cytokines that cause oxidative stress in the entire body. We may notice inflammation in extremities such as fingers or ankles, but other organs are similarly impacted, including internal organs that we cannot see.

There has been great interest in using antioxidants to combat oxidative stress. The summation of this work is that all antioxidants are beneficial in neutralizing free radicals. The key differences between antioxidants and the benefits derived depend on molecular size and hydrophobicity. Most antioxidants are too large to pass unaided through a cell or mitochondrial wall. Also, most antioxidants are hydrophilic (water-loving) and cannot easily cross the cell wall, as it is composed mostly of lipids in humans. Melatonin and Carbon 60 are unique among antioxidants due to their small size and hydrophobic (lipid-loving) nature, allowing them to pass unaided through cell and mitochondrial walls.

This is critical as most of the damaging hydroxyl free radicals are produced inside mitochondria as a natural byproduct of respiration. If there are insufficient antioxidants produced inside the mitochondria, damage to lipids, enzymes and DNA will occur. When enzymes are damaged, they can be denatured and become ineffective, resulting in reduced output of ATP from the mitochondria. When lipids are oxidized by free radical damage, they can migrate out of the mitochondria and cell into the bloodstream, where they spread oxidative stress and inflammation to other tissues. When DNA is damaged, it can become non-functional at that locus if not repaired by the body's repair systems, resulting in non-functional DNA at best and cancer at worst.

Antioxidants could even play a significant role in viral infections. The immune system produces free radical molecules, especially superoxide, to destroy pathogens. This works well against bacteria and fungi, but there is evidence that viruses have developed a way to avoid damage and use the free radicals to their advantage [13]. The resulting release of free radical molecules produced by phagocytes is called the oxidative burst. It can cause damage to healthy tissue nearby, as well as stimulating cytokines that trigger inflammation. The COVID-19 virus is an especial example of this phenomenon. The virus upon infection produces a protein that down-regulates the immune response, allowing the virus time to attach and replicate. Then it produces two other proteins that stimulate inflammation [14]. Meanwhile, the immune system ramps up to destroy the pathogen using free radical molecules that cause collateral damage to healthy tissue and further elevates the inflammatory response via cytokine messenger molecules. This is called the Cytokine Storm and the result is severe lung inflammation and often death of the host [15], resulting ironically from an over-active immune system, not the virus itself.

There have been over 100 diseases and conditions attributed to the excess production of free radical molecules [16]. Not a single disease or condition has been attributed to excess antioxidants. The worst appears to be diarrhea and mild headache experienced, for example, by hyper Vitamin C users at 10 grams per day, which quickly dissipated when reduced to more reasonable levels. Disease often starts with an activation of the immune system due to a pathogen, foreign material or foreign protein. The resulting immune response is to produce free radical molecules and cytokine messenger molecules that cause inflammation. If not stopped by antioxidants, this can result in a cascade of free radical molecule production, inflammation, and tissue damage in an increasing spiral. The end result is disease. Antioxidants can mute the free radical damage, reducing inflammation and the resulting spiraling immune response, allowing the immune system to destroy the pathogen without causing unneeded damage or death of the host [17].

There is too much accumulated evidence to ignore the fact that insufficient antioxidants in the body results in oxidative stress, inflammation, diabetes, heart disease, hypertension, autoimmune diseases and cancer. It is time to get more antioxidants into our diets.

Leonard W. Heflich is a chemist, innovator and writer. He retired after a 42-year career in the food industry. He has written and published two books, Balanced Leadership: A Pragmatic Guide for Leading and Live as Long as You Dare! A Journey to Gain Healthy, Vibrant Years. He has been awarded US Patent No. 10,842,742 to produce a solubilized form of Carbon 60. He is President and co-founder of Fuller Research, LLC, dedicated to performing research on medical applications of Carbon 60.

Bibliography

1. Tan Dun-Xian. "Mitochondria and Chloroplasts as the Original Sites of Melatonin Synthesis: A Hypothesis Related to Melatonin's Primary Function and Evolution in Eukaryotes". *Journal of Pineal Research* 54 (2013): 127-138.

2. Manchester Lucien C. “Melatonin: An Ancient Molecule That Makes Oxygen Metabolically Tolerable”. *Journal of Pineal Research* 59 (2015): 403-419.

3. Arnao Marino B. “Functions of Melatonin in Plants: A Review”. *Journal of Pineal Research* 59 (2015): 133-150.

4. Ferlazzo Nadia. “Is Melatonin the Cornucopia of the 21st Century”. *Antioxidants* 9 (2020): 1088.

5. Tan Dun-Xian. “Melatonin as a Potent and Inducible Endogenous Antioxidant: Synthesis and Metabolism”. *Molecules* 20 (2015): 18886-18906.

6. Rusanova Iryna. “Protective Effects of Melatonin on the Skin: Future Perspectives”. *International Journal of Molecular Sciences* 20 (2019).

7. Bora Nilutpal Sharma. “Protective Effect of a Topical Sunscreen Formulation Fortified with Melatonin against UV-Induced Photodermatitis: An Immunomodulatory Effect via NF-KB Suppression”. *Immunopharmacology and Immunotoxicology* (2019).

8. Warraich Umm-e-Ammara. “Aging - Oxidative Stress, Antioxidants and Computational Modeling”. *Heliyon* 6 (2020): e04107.

9. Jin, Seon-Pil. “Urban Particulate Matter in Air Pollution Penetrates into the Barrier-Disrupted Skin and Produces ROS-Dependent Cutaneous Inflammatory Response *in Vivo*”. *Journal of Dermatological Science* 91 (2018): 175-183.

10. Rendra Erika. “Reactive Oxygen Species (ROS) in Macrophage Activation and Function in Diabetes”. *Immunobiology* 224 (2019): 242-253.

11. Alberti George. “Introduction to the Metabolic Syndrome”. *European Heart Journal Supplements* 7.0205AD D3-5.

12. Spahis Schohraya. “Oxidative Stress as a Critical Factor in Nonalcoholic Fatty Liver Disease Pathogenesis”. *Antioxidants and Redox Signaling* 26.10 (2017): 519-542.

13. Mathys Leen. “The Role of Cellular Oxidoreductases in Viral Entry and Virus Infection-Associated Oxidative Stress: Potential Therapeutic Applications”. *Expert Opinion on Therapeutic Targets* 20, no. 1 (July 15, 2015): 123-143.

14. Yuen Chun-Kit. “SARS-CoV-2 Nsp13, Nsp14, Nsp15 and Orf6 Function as Potent Interferon Antagonists”. *Emerging Microbes and Infections* 9 (2020): 1418-1428.

15. Yang Lan. “The Signal Pathways and Treatment of Cytokine Storm in COVID-19”. *Signal Transduction and Targeted Therapy* 6 (2021): 255.

16. Poljsak Borut. “Achieving the Balance between ROS and Antioxidants: When to Use the Synthetic Antioxidants”. *Oxidative Medicine and Cellular Longevity* (2013):956792.

17. Poltorak, Alexander. “Cell Death and Cytokine Storms” How Your Body’s Innate Immune Response Is Crucial to Battling COVID-19”. *The Conversation* (2020).

Assets from publication with us

- Prompt Acknowledgement after receiving the article
- Thorough Double blinded peer review
- Rapid Publication
- Issue of Publication Certificate
- High visibility of your Published work

Website: www.actascientific.com/
Submit Article: www.actascientific.com/submission.php
Email us: editor@actascientific.com
Contact us: +91 9182824667