



What is oxidative stress?

Oxidative stress is an **imbalance between two different types of molecules in your body: free radicals and antioxidants**. Specifically, it means there are too many free radicals and not enough antioxidants. As a result, the excess free radicals start to harm your body's cells and tissues. They damage the different parts of cells, including **lipids (fats) and proteins**, that allow them to work normally.

Researchers believe oxidative stress plays a role in the onset of many chronic and degenerative conditions. A few examples include:

- **Cancer**. Oxidative stress damages the DNA in healthy cells, which can raise your cancer risk.
- **Cardiovascular disease**. Oxidative stress triggers plaque to form in your arteries (atherosclerosis). Plaque buildup can lead to many different problems, including

reduced blood supply to your heart (coronary artery disease) and heart attack.

- **Kidney disease.** Sustained oxidative stress can form scar tissue in your kidneys that prevents them from working as they should. This may lead to kidney failure, which can worsen to the point where you need dialysis.
- **Neurological diseases.** Researchers have linked oxidative stress to many different neurological diseases, including Alzheimer's disease, Parkinson's disease and multiple sclerosis. Excess free radicals contribute to neuron loss, which can progressively lead to dementia.
- **Respiratory diseases.** Oxidative stress and related inflammation can affect your lungs and cause conditions like asthma or chronic obstructive pulmonary disease (COPD).
- **Rheumatoid arthritis.** Free radicals contribute to the chronic inflammation that happens in people with rheumatoid arthritis.

What is the difference between free radicals and antioxidants?

Free radicals can harm you if there are too many in your body (oxidative stress). Antioxidants, on the other hand, can help protect your body from such damage.

To understand how this all works, it helps to know a bit more about what free radicals and antioxidants do in your body. Free radicals and antioxidants are two different types of molecules, or chemical compounds, that play a role in how your body works. Your body needs both types to function properly.

Your body converts the food you eat into energy. This normal, necessary process leads to the production of free radicals. They're simply a byproduct. While free radicals often have a bad reputation, they're actually not always bad. Free radicals support the work of your immune system and other crucial body processes. But you only need low or moderate levels of them.

Extensive sun exposure, stress and smoking can cause your body to make more free radicals than it needs. This overload can cause problems.

Free radicals are unstable molecules. In chemistry terms, this means they're missing an electron. They need a certain number of electrons to be stable, or complete. Free radicals search for electrons they can grab from other molecules in your body to regain their stability. This puts healthy, complete molecules in your body at risk. Free radicals can snatch electrons from those molecules, in turn damaging them and making them unstable.

But just like in the movies, a superhero can sweep in to save the day. **Antioxidants, or natural substances in foods we eat, are that superhero.** Unlike free radicals, **antioxidants don't snatch electrons from healthy cells in your body.** Instead, they **donate one of their electrons to a free radical.** **This makes the free radical complete, so it doesn't steal from other molecules in your body.** Antioxidants help keep balance in your body.

When you don't have enough antioxidants to satisfy the free radicals, those free radicals go scavenging. And your body experiences oxidative stress as a result.

What causes oxidative stress?

Anything that raises the number of free radicals in your body to unhealthy levels can cause oxidative stress. Healthcare providers sometimes call such culprits environmental factors, or environmental triggers. Known examples include:

- Environmental toxins around you.
- Smoking and tobacco use.
- Sun exposure.
- Drinking too much alcohol.
- Stress.

What are oxidative stress symptoms?

You might not always know your body is experiencing oxidative stress. It involves tiny, microscopic changes that go on behind the scenes. You may not have any symptoms for a while, and when you do, they can vary widely depending on which parts of your body are affected.

For example, extensive sun exposure can cause **sun-damaged skin**. This is when ultraviolet (UV) radiation from

the sun changes the DNA in your skin's cells. Signs you might notice include:

- Fine lines and wrinkles.
- Sun spots.
- Spider veins.

In other cases, oxidative stress doesn't cause visible changes. But you may start to feel its effects once it causes substantial damage. For example, the buildup of plaque (sticky substances that include cholesterol) in your arteries can lead to symptoms of cardiovascular disease. These might include chest pain, shortness of breath, fatigue and heart attacks.

A healthcare provider can tell you more about what you might expect in your individual situation.

How can I reduce oxidative stress?

Adding foods rich in antioxidants is one way to reduce oxidative stress. Healthcare providers recommend getting antioxidants from a variety of foods. That's because there isn't one antioxidant that's a superfood or responsible for

knocking out all the free radicals. **Lots of antioxidants work together to achieve the greatest health benefit.**

This chart lists some key antioxidants and examples of foods that contain them.

Antioxidant
Vitamin C
Food sources Citrus fruits like oranges and grapefruit, kiwi, strawberries, cantaloupe, red or green bell peppers and broccoli.
Vitamin E
Food sources Nuts like almonds, peanuts and hazelnuts, as well as sunflower seeds, spinach and broccoli.
Selenium
Food sources

<h2>Antioxidant</h2>
Seafood like tuna and salmon, and eggs and brown rice or whole-wheat bread.
<h2>Beta carotene</h2>
Food sources Carrots, cantaloupe, apricots, mangos, sweet potatoes and kale.

In some cases, healthcare providers recommend taking dietary supplements to help you get the antioxidants you need. But in general, getting your nutrients from food is best.

The **Mediterranean diet** is a way of eating that's high in antioxidants. Research has shown it has many benefits for your health. And you can talk to a dietitian to get advice tailored to your unique nutritional needs.

A note from Cleveland Clinic

Oxidative stress is one of those processes that happen inside your body without you even realizing it. But it happens often, and researchers are continuing to uncover what that means for your health. The good news is it's within your power to take some steps to combat its harmful effects.

Some things you can't control, like your exposure to toxins in the air or water. But you may be able to eat certain foods that reduce the number of free radicals in your body. You can also avoid tobacco products and protect your skin when you need to be in the sun. Talk to your healthcare provider about changes you can make to reduce oxidative stress and improve your health.

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References

Cleveland Clinic's health articles are based on evidence-backed information and review by medical professionals to ensure accuracy, reliability and up-to-date clinical standards.

- Forman HJ, Zhang H. Targeting oxidative stress in disease: promise and limitations of antioxidant therapy (<https://pubmed.ncbi.nlm.nih.gov/34194012/>) [published correction

appears in *Nat Rev Drug Discov.* 2021 Aug;20(8):652]. *Nat Rev Drug Discov.* 2021;20(9):689-709. Accessed 2/29/2024.

- Hajam YA, Rani R, Ganie SY, et al. Oxidative Stress in Human Pathology and Aging: Molecular Mechanisms and Perspectives (<https://pubmed.ncbi.nlm.nih.gov/35159361/>). *Cells.* 2022;11(3):552. Accessed 2/29/2024.
- National Institutes of Health (U.S.). Dietary Supplement Fact Sheets. Accessed 2/29/2024.
- Pizzino G, Irrera N, Cucinotta M, et al. Oxidative Stress: Harms and Benefits for Human Health (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5551541/>). *Oxid Med Cell Longev.* 2017;2017:8416763. Accessed 2/29/2024.
- Teleanu DM, Niculescu AG, Lungu II, et al. An Overview of Oxidative Stress, Neuroinflammation, and Neurodegenerative Diseases (<https://pubmed.ncbi.nlm.nih.gov/35682615/>). *Int J Mol Sci.* 2022;23(11):5938. Accessed 2/29/2024.

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