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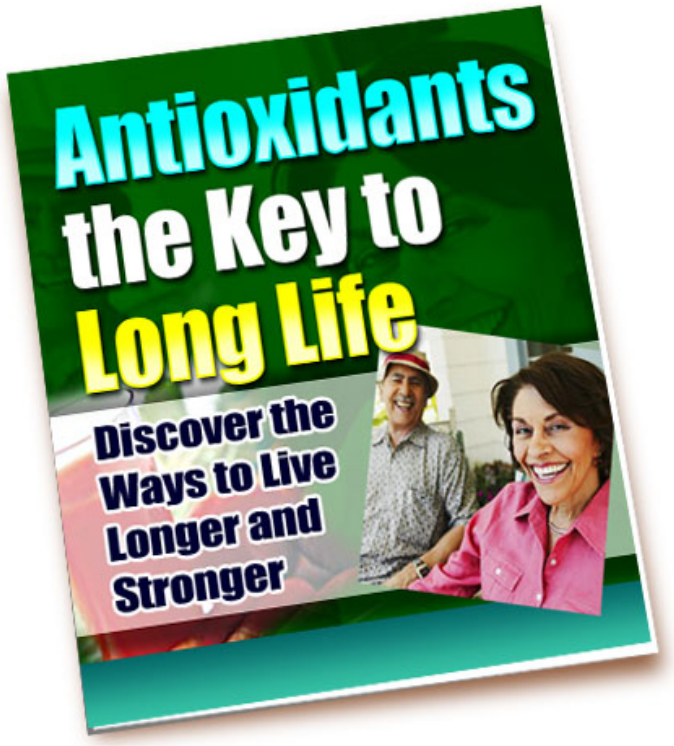
Antioxidants – The Key to Long Life



You are only as old as your cells.

Research shows that cells are only allowed so many cell divisions in a human lifetime before they would have to give out. Based on their findings, scientists say that by the time you are 20 years old, most of the cells that make up your body have already used up half of their available cell divisions in their cell lifespan. That means by the time you are 40, your cells may only have 30 per cent of cell divisions left. This is actually the reason behind the physical changes that goes on not only inside but outside the body as you approach your years.

When your cells finally use up their naturally allotted cell divisions, the result is death. It is an inevitable occurrence and there's no stopping it. There is however a way to retard it though. Recent research has found a way to give you new hope, a way to rejuvenate and extend the lifespan of cells.

What causes aging?

Much of scientific research these days are focused on finding a solution to aging. The aging process brings with it not only wrinkly skin or tired joints and muscles. Those can be tolerated. After all, they are part of the natural cycle of life. But what isn't natural is disease. They are disorders – unnatural conditions of the body.

Aging is caused by harmful molecules called "free radicals." This was according to Denham Harman, M.D., Ph.D., who first proposed the theory in the 1950s. Since then, scientists and researchers have sought to understand the body's oxidation process and free radicals contribute in its acceleration.

There is growing evidence that the production of reactive oxygen species (ROS), including free radicals, is behind the aging process and initiation of age-related disease. The more free radicals you have in your body, the faster the aging process becomes.

Free radicals are harmful, unstable substances (rogue oxygen molecules) that develop after oxidation, which is a naturally occurring process of the body. Free radicals are not harmful in themselves. In fact, they can be beneficial. The problem lies in the fact that free radicals are damaged molecules, which means that they are missing one electron.

Now, it is but natural for molecules to want to get their full complement of electrons, but in order to do that, they would have to "steal" them from other molecules surrounding them. Free radicals therefore react with other molecules, leading to the latter's damage.

Depending on the circumstances, this tendency of free radicals to react can be good, but only if the molecules they react with are harmful. The trouble is free radicals do not distinguish between healthy and harmful molecules so that there is a great possibility that they would also "attack" your other healthy cells, causing massive cellular damage, tissue damage, and eventually resulting in a chronic disease or disorder that includes not only aging, but something more serious like cancer.

It is impossible for us to avoid damage by free radicals. Free radicals arise from sources both inside (endogenous) and outside (exogenous) our bodies. Oxidants that develop from processes within our bodies form as a result of normal aerobic respiration, metabolism, and inflammation. Exogenous free radicals form from environmental factors such as pollution, sunlight, strenuous exercise, x-rays, smoking, and alcohol.

The human immune system and antioxidant activity becomes weaker and less efficient with age. This reduced effectiveness in turn helps to explain the rising incidence of cancer and life threatening infections in older people.

In their focused attempts to find a solution to aging and other chronic diseases, scientists have finally made a breakthrough with the discovery of the anti-aging properties of antioxidants.

What are antioxidants?

Antioxidants are chemical substances found in nature. They are part of a group of vitamins, such as vitamin C, vitamin E, vitamin A (beta-carotene), etc., and nutrients like selenium, lutein, and lycopene.

Functions

Oxygen damage (oxidation) to your cells results when there are too many free radicals present inside the body. Researchers surmise that such damage may be partly responsible for the effects of aging and certain diseases. How then does the human body cope?

The question led scientists to discover the existence of certain substances in food that may play a role in protecting against such damage. By donating electrons to stabilize and, in effect, ***neutralize*** the harmful effects of the free radicals, antioxidants can block this damage.

How they work:

Ultimately, what antioxidants do is to block the process of oxidation by neutralizing free radicals. In doing so, the antioxidants themselves become oxidized. That is why there is a constant need to replenish our antioxidant resources.

Antioxidants work in a two-way process. First is the ***chain-breaking*** process.

When a free radical releases or steals an electron, a second radical is formed. This molecule then turns around and does the same thing to a third molecule, continuing to generate more unstable products. The process continues until termination occurs – that is, when either the radical is

stabilized by a chain-breaking antioxidant such as beta-carotene and vitamins C and E, or it simply decays into a harmless product.

The second process is more on the ***preventive*** side.

Antioxidant enzymes like superoxide dismutase, catalase, and glutathione peroxidase prevent oxidation by reducing the rate of chain initiation. This time, instead of waiting for the free radicals to make a long chain of free radicals, antioxidants scavenge initiating radicals and destroy them before oxidation is set in motion. They can also prevent oxidation by stabilizing transition metal radicals such as copper and iron.

The effectiveness of any given antioxidant in the body depends on which free radical is involved. It may also depend on how and where the free radical is generated and where the target of damage is. That is why you may find that some antioxidants work well in one particular system but may not protect against free radicals in a completely different system.

Worse still, an antioxidant may even act as a "**pro-oxidant"** that generates toxic oxygen species in certain circumstances.

Types of Antioxidants

There are several types of antioxidant nutrients that our body needs in order to control free radical damage in our cells. Each of these nutrients is unique in terms of its structure and antioxidant function.

- ***Vitamin E*** is actually a generic term that refers to a group of nutrients (8 have been found so far). These nutrients all exhibit biological activity of the isomer tocopherol (**NOTE:** An isomer is one of two or more molecules that have the same chemical formula but different atomic arrangements).

  The most widely available isomer is alpha-tocopherol. It has the highest biopotency, or strongest effect in the body. And because it is fat-soluble, it is in a unique position to safeguard cell membranes – largely composed of fatty acids – from damage by free radicals. Alpha-tocopherol also protects the fats in low-density lipoproteins (LDLs, or the "bad" cholesterol) from oxidation.

- Ascorbic acid, also known as ***Vitamin C***, is a water-soluble vitamin and one of the most commonly found antioxidants. Its prime function is to scavenge free radicals that are in an aqueous (watery) environment, such as inside your cells. Vitamin C has a synergistic effect with Vitamin E, which means that both work together to quench free radicals. Vitamin C also regenerates the reduced (stable) form of Vitamin E.

- Out of the 600 carotenoids identified to date, ***Beta-carotene*** (also known as Vitamin A) is the most widely studied. As a water soluble vitamin, it is similar to Vitamin C in that it acts by quenching singlet oxygen (an energized but uncharged form of oxygen that is toxic to cells). Beta-carotene is also excellent at scavenging free radicals in low oxygen concentration.

- ***Selenium*** is a trace element and a mineral. We only need very small quantities of selenium, but without it we could not survive. This is because selenium forms the active site of several antioxidant enzymes including glutathione peroxidase.

- Similarly, the minerals ***Manganese*** and ***Zinc*** are trace elements that form an essential part of various antioxidant enzymes.

Other Antioxidants

In addition to antioxidants we mentioned above, there appear to be many other nutrients and compounds that have antioxidant properties. Among them are the following:

- Superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx), all of which serve as your primary line of defense in destroying free radicals.

- Coenzyme Q10 (CoQ10, or ubiquinone) – essential to energy production and can also protect the body from destructive free radicals

- Uric Acid – a product of DNA metabolism that has increasingly been recognized as a powerful antioxidant

- Phytochemicals – found in plants with antioxidant properties and health-promoting potentials

Proven Key to Long Life

For the past ten years, since they discovered the link between free radicals and degenerative diseases such as cancer, researchers have focused on the beneficial properties of antioxidants and the important role they play in possibly prolonging human life.

According to US scientists, boosting the body's levels of natural antioxidants could be the key to a long life. Numerous studies in simple organisms, such as yeast, worms, and flies have supported this theory by showing that enhancing production of natural antioxidants can extend life. However, evidence that antioxidants can slow the aging process in mammals has been less convincing.

Of Genes and Mice

To investigate whether increased concentrations of natural antioxidants give mammals longer lives, Peter S. Rabinovitch of the University of Washington in Seattle and his colleagues came up with a study involving genetically engineered mice. The mice were purposely engineered to over-express a gene responsible for making the antioxidant called ***catalase.***

Normally, the catalase that a cell makes goes directly into organelles known as *peroxisomes.* What Rabinovitch and his colleagues did was to design a genetic manipulative process so that in some of the mice, the extra catalase went into its normal location while in the rest of the mice, the extra catalase went into the cell nucleus.

A third group of the engineered mice directed the enzyme into the *mitochondria*, the cell's energy-producing organelles. As a side effect of converting food into energy, mitochondria produce most of an organism's free radicals.

The study showed no difference in life span between normal animals and those engineered to keep the extra catalase in the nucleus. And those mice engineered to direct catalase to its usual place, in peroxisomes, showed only a modest increase in life span.

Rabinovitch and his colleagues, however, found that animals that guided catalase to mitochondria lived significantly longer than normal mice. In fact, the process seemed to add about 5 months to their normal 3-year life span.

When the researchers dissected some of the mice, they found early signs of age-associated disease, such as cataracts and heart disease, at later ages in the long-lived, engineered mice than in the others. This showed that mice engineered to produce high levels of an antioxidant enzyme have a life span that is 20% longer than those of normal mice.

Results of the study also showed that they had less heart and other age-related diseases.

If the same is true among humans, then it's possible that people could live beyond 100 years.

The Power of Reishi

In a thoroughly different study, ***Reishi***, a Chinese mushroom (also known as Ganoderma lucidum, Lingzhi, or Ling Zhi), was shown to cause a significant post-ingestion increase in plasma antioxidant capacity with peak response at 90 minutes. This means that Reishi can cause increase in urine antioxidant capacity in just 3 hours.

Published in 2004 by the International Journal of Food Sciences and Nutrition, the results of the study indicate that Reishi intake causes an acute increase in plasma antioxidant capacity.

Reishi is a powerful antioxidant. In another laboratory study, Reishi significantly elevated the free radical scavenging ability of blood and was so strong that even after the Reishi extract was absorbed and metabolized the scavenging effect still continued.

Dr. Vladimir Kupin of the Cancer Research Centre in Moscow found a compound in Reishi called ***GLB 7*** which served as the main proponent in decreasing the production of oxygen free radicals. This makes Reishi more effective as a free radical scavenger than isolated refined compounds.

A laboratory study with fruit flies also showed just how powerful an antioxidant Reishi is. The flies, which have a very similar genetic make up to humans, were used in experiments to prove that Reishi significantly lengthened the life span of those that had been fed Reishi compared to controls.

Supplements

Even though most damage caused by free radicals is repaired, a fraction may still remain. This is not at all helped when we constantly expose ourselves to ultraviolet radiation from the sun and airborne pollutants such as cigarette and smoke.

Eventually, the damage may overwhelm the body's natural defenses so that not even intake of antioxidants from our diet can protect against damages. Soon, our bodies develop reactions that accumulate overtime, like aging or chronic diseases such as Alzheimer's disease, Parkinson's disease, rheumatoid arthritis, atherosclerosis, and more. By consuming antioxidant vitamins, these diseases may be prevented.

How much do you need?

It should be noted that antioxidant supplements are not cure in themselves. The American Heart Association, for one, does not recommend using antioxidant supplements "until more complete data are in." Instead, what they suggest is for "people to eat a variety of foods daily from all of the basic food groups."

In April 2000, the Food and Nutrition Board of the Institute of Medicine, an advisory group that is part of the National Academy of Sciences, has also reported that Vitamin C, Vitamin E, selenium, and carotenoids like beta-carotene should come from food, not supplements, in order to make use of their inherent antioxidant properties.

Since 1941, the Food and Nutrition Board has established a Recommended Dietary Allowance (RDA), a daily intake goal for nearly all (98 percent) healthy individuals. It has also developed a "tolerable upper intake level" (UL), which is the maximum amount of a nutrient that health individuals can take each day without risking adverse health effects. The Board does this by determining the types and quantities of nutrients that are needed for healthy diets through scientific literature review, disease-protecting nutrients, and data interpretation on the consumption of these nutrients.

Below is the Dietary Reference Intakes or DRIs in the 2000 report for Vitamin C, Vitamin E, Selenium, and Carotenoids:

- ***Vitamin E*** – RDA for adults is 15 mg; UL for adults is 1,070 mg (natural vitamin E) or 785 mg (synthetic vitamin E)

- ***Vitamin C*** – RDA for adults is 75 mg (for women) or 90 mg (for men); UL for adults is 2,000 mg

- ***Beta-carotene*** – Research indicates that it is not toxic if you consume beyond what is in a multivitamin and your regular diet. Still, chronic high doses should be wisely avoided.

- ***Selenium*** – RDA for adults is 55 micrograms; UL for adults is 400 micrograms

Antioxidant supplementation is not a problem in itself. What makes it potentially dangerous is that if you take more than what is recommended, there is a chance that you are doing more harm to your body than good. Just remember that aging is a fact among humans. You cannot stop yourself from aging. What you can only do is to slow down the process.

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