THE HEALING POWER OF HYDROGEN WATER

365 DAILY HEALTH

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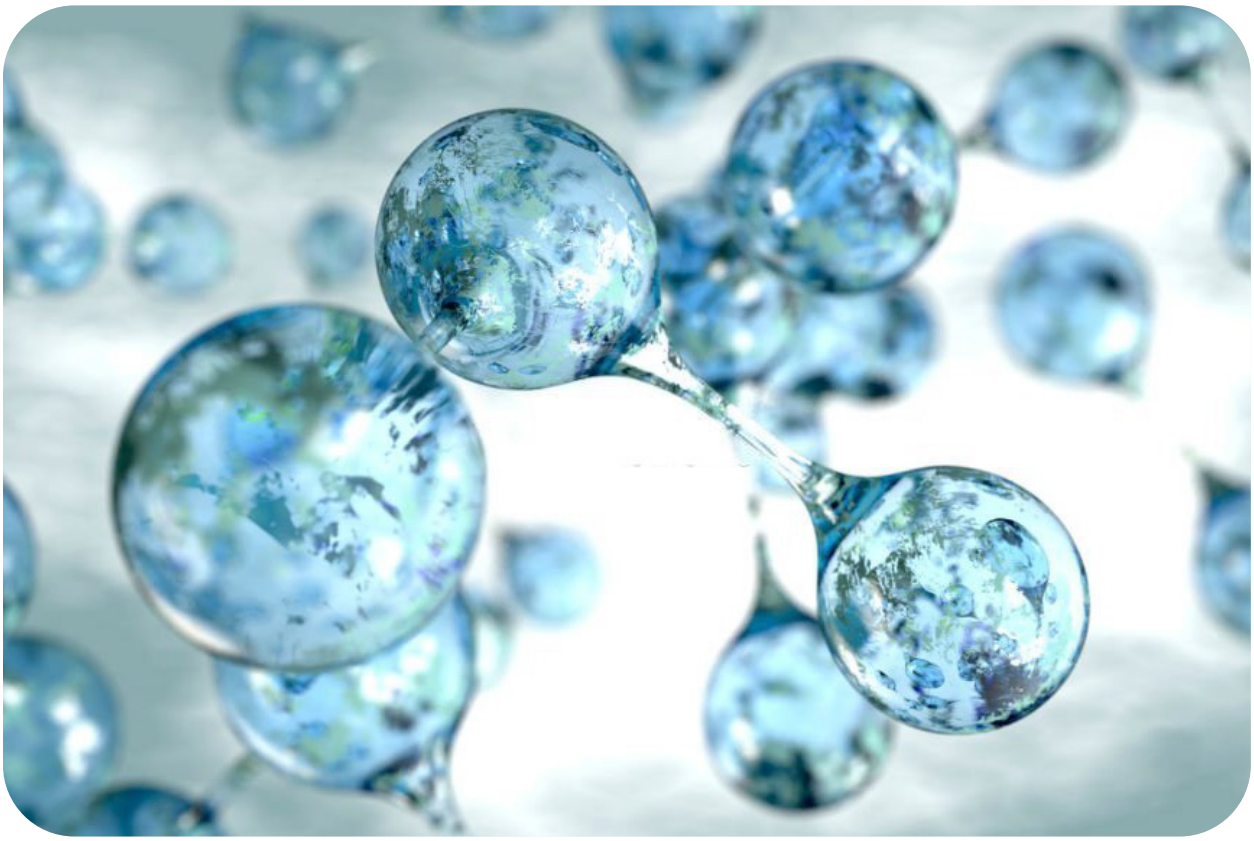
SUMMARY

Free radicals are highly reactive molecules that can damage cells, causing inflammation and contributing to the development of chronic diseases such as cancer, heart disease, and diabetes. Oxidative stress occurs when the body's ability to neutralize free radicals is overwhelmed. Molecular hydrogen is a powerful antioxidant that scavenges free radicals, reducing oxidative stress and protecting cells from damage.

Hydrogen water has numerous benefits for the body. It improves hydration by increasing the absorption of water into cells. It also increases energy levels and enhances athletic performance by delivering more oxygen to muscles. Hydrogen water also protects the brain from damage caused by stroke and other neurological conditions. In addition, it may help to prevent or treat arthritis, inflammatory bowel disease, and other inflammatory conditions.

Looking to boost your health and fight disease with the power of hydrogen? Then be sure to check out this book on the benefits of hydrogen water! With research-backed evidence, it explains how molecular hydrogen works at a cellular level, describes its many beneficial effects on various parts of the body and outlines practical ways to start incorporating it into your lifestyle. Whether you're an athlete looking for an edge or simply want to improve your overall health and well-being, hydrogen water is one supplement that's certainly worth considering. So read on to find out why!

CHAPTER 1
HYDROGEN 101



Hydrogen is the lightest element in the universe, and it's also incredibly abundant. Hydrogen is the lightest element in the universe making it the first element of the periodic table. In terms of abundance, it is second only to helium.

Hydrogen is an energy-dense fuel that can be used to power everything from cars to houses. It's also a key component of many biochemical reactions in the body, including those that help to produce energy. While hydrogen gas is safe to inhale at low concentrations, it can be explosive at high concentrations. This is why most hydrogen fuel is stored in tanks as compressed gas or liquid.

Hydrogen is an essential part of our bodies, and it's involved in many important processes. For example, hydrogen is a key component of ATP (adenosine triphosphate), which is the energy currency of our cells.

$$ATP + H2O \rightarrow ADP + Pi$$

In this reaction, ATP is converted to ADP (adenosine diphosphate) and Pi (inorganic phosphate). This process releases energy that our cells can use for various functions.

Molecular hydrogen (H2) is a gas at room temperature and pressure, but it can be liquefied by cooling or compressing it. Liquid hydrogen has a boiling point of -252.87°C (-423.17°F).

Hydrogen can be delivered to the body in several ways, including through food and supplements. Foods that are high in hydrogen include fruits, vegetables, legumes, and nuts. These foods typically contain large amounts of water, which helps to keep the hydrogen concentration low. Hydrogen supplements are also available, and they can be taken in pill form or inhaled as a gas.

The most special however is hydrogen water. Molecular hydrogen is so small that it can easily dissolve in water. This makes it possible to create hydrogen-rich water, which has a variety of potential health benefits. Hydrogen water is simply water that has been saturated with molecular hydrogen gas. This can be done by bubbling H2 gas into water or by using a special device called a hydrogenator.

Due to its small mass and neutral charge, H2 is relatively stable and does not interact with other molecules in the body. This means that it can easily pass through cell membranes and enter the mitochondria, where it can be used to produce energy.

Before we delve into the details of hydrogen water, let's look at some fun facts regarding hydrogen:

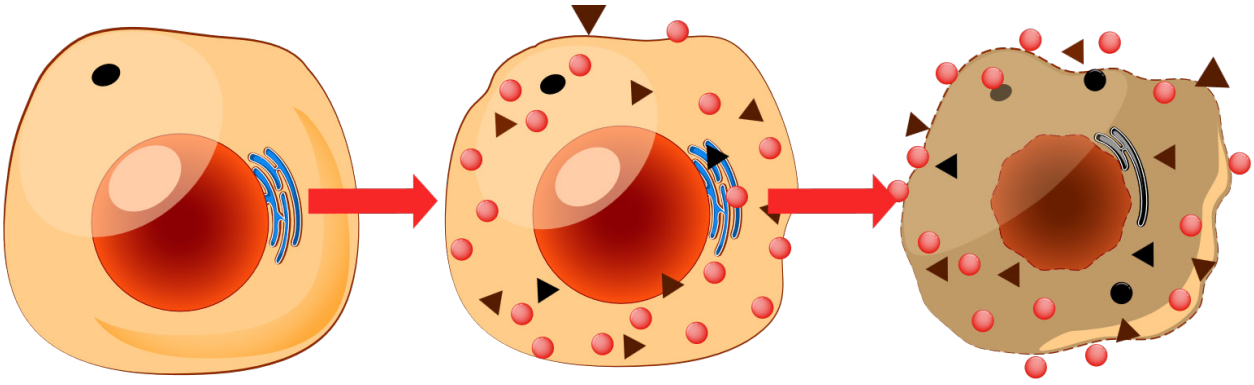
- It is a colourless, odourless, tasteless, non-toxic gas
- Hydrogen is found in all living things, including humans. In fact, water (H2O) is made up of two hydrogen atoms bonded to one oxygen atom
- The atomic symbol for hydrogen is H, and its atomic number is 1

- The name "hydrogen" comes from the Greek words "hydro" and "genes," which mean "water" and "forming," respectively.
- Hydrogen is the lightest element in the universe
- Hydrogen gas is flammable and explosive but it needs an oxidizer to ignite
- Hydrogen is the most abundant element in the universe, making up about 75% of all matter
- Hydrogen is involved in many biochemical reactions, including those that produce energy in the body.
- While hydrogen is an essential part of our bodies, it's also important to note that too much of it can be harmful. Inhaling high concentrations of hydrogen gas can lead to asphyxiation, and high levels of hydrogen in the blood can cause tissue damage. Therefore, it's important to use caution when handling and storing hydrogen fuel.

The benefits of molecular hydrogen can be understood much better once oxidative stress is introduced and how it causes harm to the human body. In the next chapter, we will learn about oxidative stress and how it affects the body. We will also learn about the different ways in which molecular hydrogen can help to protect against oxidative stress-related damage.

CHAPTER 2

OXIDATIVE STRESS AND FREE RADICALS



The phenomenon of oxidative stress occurs when the balance between the production of reactive oxygen species (ROS) and a cell's ability to readily detoxify the resulting reactive intermediates is shifted, resulting in cellular damage. The resultant imbalance between ROS production and antioxidant defence promotes changes in cell structure and/or function.

ROS are formed as a natural by-product of the metabolic processes required for life. In general, ROS at low levels acts as important signalling molecules within cells, regulating a diverse array of functions including cell proliferation, differentiation, and death. For example, small amounts of ROS can act as secondary messengers to stimulate or inhibit gene expression. When produced at higher levels, ROS causes damage to cellular biomolecules including DNA, proteins, and lipids. This cellular oxidative damage has been implicated in the pathophysiology of many chronic diseases such as cancer, cardiovascular disease, Alzheimer's disease, and diabetes.

ROS are chemically reactive molecules that contain unpaired electrons in their outermost orbital. This electronic configuration gives them the ability to readily interact with and damage cellular biomolecules. The best-characterized ROS is the superoxide anion (O2-•), which is generated enzymatically by the reduction of oxygen. While O2-• is not particularly reactive, it can give rise to other more reactive ROS through a series of redox reactions.

For example, O2-• can be converted to hydrogen peroxide (H2O2) by the enzyme superoxide dismutase. H2O2 is then further converted to the highly reactive hydroxyl radical (•OH) by metal-containing enzymes known as peroxidases.

In simple terms, when this balance is shifted in favour of ROS production, oxidative stress occurs.

The generation of ROS is a normal part of cellular metabolism, and under physiological conditions, cells are able to effectively detoxify and repair the resulting oxidative damage. However, when cells are exposed to stressful conditions such as infection, inflammation, or UV irradiation, ROS production can increase dramatically. This imbalance between ROS production and antioxidant defence leads to oxidative stress and associated cellular damage.

There are many sources of oxidative stress in the body. For example, inflammation creates a pro-oxidant environment by increasing the release of ROS-generating enzymes from immune cells. In addition, exposure to environmental toxins such as cigarette smoke and air pollution can also lead to oxidative stress. Furthermore, as we age, our cells become less effective at repairing oxidative damage, which contributes to the negative health effects associated with ageing.

Free radicals are generated endogenously as a result of normal cellular metabolism. For example, the mitochondria produce ROS as a by-product of aerobic respiration. In addition, immune cells generate ROS as part of the inflammatory response. These free radicals play an important role in cell signalling and regulation of gene expression.

However, when cells are exposed to stressful conditions, ROS production can increase dramatically, leading to oxidative stress.

In addition to endogenous sources, exogenous sources of free radicals can also contribute to oxidative stress. For example, exposure to UV radiation from the sun generates free radicals that can damage DNA and other cellular biomolecules.

Cigarette smoke is another major source of exogenous free radicals and has been linked to numerous health problems including cancer, cardiovascular disease, and emphysema.

There are several different types of free radicals, depending on the number of unpaired electrons in the molecule. The most common free radicals are listed below:

- Superoxide anion (O2•-): This is the simplest type of free radical and contains one unpaired electron. Superoxide anions are generated by the reduction of oxygen and can be converted to other more reactive free radicals such as hydrogen peroxide and hydroxyl radicals.
- Hydrogen peroxide (H2O2): This molecule contains two unpaired electrons and is generated by the oxidation of superoxide anions. Hydrogen peroxide can be further converted to the highly reactive hydroxyl radical.
- Hydroxyethyl radical (•OH): This is the most reactive type of free radical and contains three unpaired electrons. Hydroxyl radicals are generated by the oxidation of hydrogen peroxide and can cause extensive cellular damage.

Hydroxyl radicals are highly reactive and can damage all types of biomolecules including DNA, proteins, and lipids. In addition, hydroxyl radicals can propagate a chain reaction by oxidizing other molecules, which generates more free radicals.

The mechanism of hydroxyethyl radical-induced cellular damage is shown below:

1) Hydroxyethyl radicals react with DNA, causing strand breaks and mutations.
2) Hydroxyethyl radicals react with proteins, causing structural changes and inactivation.
3) Hydroxyethyl radicals react with lipids, causing lipid peroxidation and cell membrane damage.
4) Hydroxyethyl radicals generate new free radicals through a process known as oxidation-reduction (redox). This leads to a chain reaction that can damage multiple biomolecules.

The end result of hydroxyethyl radical-induced cellular damage is cell death.

In addition to the damage they cause, free radicals also play an important role in several beneficial processes in the body. For example, ROS are essential for cell signalling and regulation of gene expression. In addition, ROS have been shown to have antimicrobial activity against bacteria and viruses.

Furthermore, free radicals are involved in the process of autophagy, which is a type of cell death that helps to remove damaged cells and debris from the body. Autophagy is a normal physiological process that occurs in all cells and is essential for maintaining cellular homeostasis.

However, the overproduction of free radicals can lead to oxidative stress and damage to biomolecules. And while in theory and pathology oxidative stress seems harmful, individual impact on various organs and systems can be very different. The more pronounced and specific the symptoms are, the more easily oxidative stress can be linked to the disease.

In the next chapter, we will look at each system of the body individually and see how harmful free radicals and stress are.

CHAPTER 3

EFFECTS OF OXIDATIVE STRESS ON BODY

Oxidative stress has a wide range of effects on the body, depending on the organs and systems involved. In general, oxidative stress can cause damage to cells, proteins, and DNA. This can lead to the development of chronic diseases such as cancer, as well as accelerated ageing.

The effects are not limited to any one particular system in the body but can manifest in many different ways.

1. CARDIOVASCULAR SYSTEM

The cardiovascular system is one of the systems most affected by oxidative stress. Oxidative stress can damage the lining of blood vessels, known as the endothelium. This damage can lead to inflammation and the formation of plaques on the vessel walls, which can narrow or block the vessels. This increases the risk of heart attacks and strokes.

Atherosclerosis, the entire process of plaque formation, is considered to be primarily caused by oxidative stress. LDL cholesterol is oxidized by free radicals, and this oxidized LDL then damages the endothelium. The build-up of oxidized LDL in the vessel walls leads to the formation of plaques.

Endothelial NO production is impaired in atherosclerosis. This leads to further damage to the endothelium as well as reduced blood flow. Reduced blood flow can cause ischemia, which is a lack of oxygenated blood reaching the tissues. This can lead to tissue damage or even death.

Oxidative stress can also damage the heart muscle cells directly, leading to cardiomyopathy, or heart failure. Heart failure is a condition in which the heart is unable to pump enough blood to meet the body's needs. It is a leading cause of death in the United States. Hypertension is another cardiovascular disease that is partly caused by oxidative stress. Oxidative stress damages the walls of blood vessels, causing them to become stiff and narrow. This increases the pressure within the vessels and leads to high blood pressure.

Likewise, peripheral artery disease is also partly caused by oxidative stress. In this condition, the arteries that supply blood to the legs and feet become narrow and hardened, reducing blood flow to these areas. This can cause pain, cramping, and fatigue in the legs and feet. Oxidative stress can also contribute to the development of aneurysms. An aneurysm is a bulge or ballooning in a blood vessel that can rupture and cause life-threatening bleeding.

2. NERVOUS SYSTEM

Oxidative stress has been implicated in a number of neurological disorders, including Alzheimer's disease, Parkinson's disease, and amyotrophic lateral sclerosis (ALS).

Alzheimer's disease is the most common form of dementia, a condition characterized by memory loss and cognitive decline. Oxidative stress is thought to play a role in the development of Alzheimer's disease by damaging neurons in the brain. This damage leads to the formation of plaques and tangles, which are characteristic of Alzheimer's disease.

Parkinson's disease is a neurological disorder that affects movement. It is caused by the death of dopamine-producing neurons in the brain. Oxidative stress is thought to contribute to the death of these neurons. Amyotrophic lateral sclerosis (ALS) is a progressive neurological disorder that attacks nerve cells in the brain and spinal cord. The exact cause of ALS is unknown, but oxidative stress is thought to play a role in the disease.

Huntington's disease is another neurological disorder that is caused by oxidative stress. In this disease, the nerve cells in the brain are damaged, leading to involuntary movements, cognitive decline, and psychiatric problems. The pathophysiology of Huntington's disease is similar to that of Parkinson's disease.

Multiple sclerosis (MS) is an autoimmune disease in which the body attacks the myelin sheath, a protective covering that surrounds nerve cells. This damage disrupts communication between the nerves and the brain, leading to a wide range of symptoms. Oxidative stress is thought to contribute to the development and progression of MS. It does this by damaging the myelin sheath and by causing inflammation.

Brain tumours are also thought to be partly caused by oxidative stress. In particular, gliomas, which are tumours that arise from glial cells, are thought to be caused by the accumulation of oxidative damage. In glioma cells, this damage leads to the activation of a protein called NF-kB, which promotes cell growth and survival. As a result, the cells divide uncontrollably and form a tumour.

A stroke is a medical emergency that occurs when the blood supply to the brain is cut off. This can be caused by a blockage or rupture of a blood vessel. Oxidative stress is thought to contribute to the development of stroke by damaging the walls of blood vessels and making them more susceptible to rupture.

The most implicative evidence for this comes from studies in animal models of stroke. Studies have shown that antioxidants can reduce the damage caused by oxidative stress and improve outcomes following a stroke (1).

Lastly, epilepsy is a neurological disorder characterized by recurrent seizures. Oxidative stress is thought to contribute to the development of epilepsy by damaging neurons in the brain. The damage caused by oxidative stress in epilate cells leads to the activation of a protein called NMDA, which is known to be involved in seizure activity.

3. ENDOCRINE SYSTEM

Oxidative stress can affect the function of the endocrine system, which is responsible for producing hormones. Hormones are chemical messenger molecules that travel through the bloodstream and regulate the activity of various organs and tissues. When the endocrine system is not functioning properly, it can lead to a variety of problems such as hormonal imbalances, infertility, and even cancer.

The most important disease linked to oxidative stress is diabetes. Diabetes is characterized by high levels of blood sugar, which can damage various organs and tissues. One of the main complications of diabetes is diabetic neuropathy, which is a type of nerve damage that can cause pain, numbness, and tingling in the extremities.

The way free radicals play a role in the development of diabetes is through their ability to damage insulin-producing cells in the pancreas. Insulin is a hormone that helps to regulate blood sugar levels. When these cells are damaged, it can lead to an increase in blood sugar levels, which can eventually damage the nerves, kidneys, and other organs. The complications of diabetes can be serious and even life-threatening.

The thyroid gland is another endocrine gland that can be affected by oxidative stress. The thyroid gland produces hormones that regulate the body's metabolism. When the thyroid gland is not functioning properly, it can lead to a variety of problems such as weight gain, fatigue, and depression.

Free radicals can damage the cells of the thyroid gland, which can lead to overproduction or underproduction of thyroid hormones. This can eventually lead to a condition called hypothyroidism, which is characterized by low levels of thyroid hormone in the blood. Hypothyroidism can cause a variety of symptoms such as weight gain, fatigue, and depression.

Hashimoto's disease is an autoimmune disorder that can damage the thyroid gland. In this condition, the body's immune system attacks the thyroid gland, which can eventually lead to hypothyroidism. Hashimoto's disease is thought to be caused, at least in part, by oxidative stress.

Similarly, Grave's disease is another autoimmune disorder that can damage the thyroid gland. In this condition, the body's immune system attacks the thyroid gland, which can eventually lead to hyperthyroidism. The free radicals produced during the inflammation can damage the thyroid gland and lead to the overproduction of thyroid hormones.

Diseases of the adrenal gland can also be caused by oxidative stress. The adrenal glands are responsible for producing hormones that help to regulate the body's stress response. When the adrenal glands are not functioning properly, it can lead to a variety of problems such as high blood pressure, anxiety, and fatigue.

Cushing's syndrome is a condition that can be caused by the overproduction of cortisol, a hormone produced by the adrenal gland. Cortisol is a hormone that helps to regulate the body's stress response. When the adrenal gland produces too much cortisol, it can lead to a variety of symptoms such as weight gain, high blood pressure, and anxiety.

Free radicals are thought to play a role in the development of Cushing's syndrome by damaging the cells of the adrenal gland. This can eventually lead to the overproduction of cortisol.

Pituitary tumours are also linked to oxidative stress. The pituitary gland is responsible for producing hormones that regulate various body processes such as growth, metabolism, and reproduction. When the pituitary gland is not functioning properly, it can lead to a variety of problems such as dwarfism, obesity, and infertility.

Oxidative stress can also affect the function of the reproductive system. The reproductive system is responsible for producing eggs and sperm. Free radicals can damage the cells of the reproductive system, which can lead to infertility. Free radicals can also damage the DNA of sperm, which can lead to genetic defects in the offspring.

As seen in recent times, PCOS or polycystic ovarian syndrome has been on the rise and is another condition thought to be caused by oxidative stress. PCOS is a condition that can cause infertility, irregular periods, and obesity. Free radicals are thought to damage the cells of the ovaries, which can eventually lead to the development of PCOS.

The lifestyle choices made in recent years are said to be a major contributing factor to the rising levels of oxidative stress in the body. Poor diet, lack of exercise, and exposure to environmental toxins can all lead to the production of free radicals. These free radicals can damage the cells and tissues of the body, which can eventually lead to a variety of health problems.

4. CANCER

Cancer is one of the most feared diseases and has been linked to oxidative stress. Studies have shown that oxidative stress can damage DNA, leading to mutations that can lead to cancer (2).

Damage to the breast epithelium has been linked to the development of breast cancer, and oxidative stress is thought to be one of the mechanisms by which this damage occurs. In the majority of breast carcinomas, oxidative stress can be induced by the overexpression of thymidine phosphorylase (TP). TP is an enzyme that catalyzes the conversion of thymidine to deoxyuridine, which is a marker for oxidative DNA damage. Genetic polymorphisms in TP have been linked to an increased risk of developing breast cancer.

Oxidative stress has also been linked to the development of colon cancer. In a study of rats, those that were given a diet high in fat and cholesterol had an increase in oxidative stress and inflammation, which led to the development of colon tumours (3). The rats that were not given the high-fat diet did not develop tumours.

Studies have also shown that oxidative stress can promote the growth of existing cancer cells. In one study, pancreatic cancer cells were treated with antioxidants, and it was found that the antioxidants prevented the cancer cells from growing (4). However, when the pancreatic cancer cells were treated with a compound that generates oxidative stress, the cancer cells began to grow. These results suggest that oxidative stress can promote the growth of cancer cells.

Bladder cancer is another type of cancer that has been linked to oxidative stress. The common risk factor for bladder cancer is cigarette smoking, which generates oxidative stress. Industrial chemicals that are used in the production of dyes and rubber can also generate oxidative stress, and these chemicals have been linked to an increased risk of developing bladder cancer. The exogenous metabolite aristolochic acid, which is found in some herbal remedies, has also been linked to bladder cancer.

Aristolochic acid is thought to cause oxidative stress, leading to DNA damage and the development of cancer.

Prostate cancer is the most common type of cancer in men, and oxidative stress has been linked to its development. The free radicals lead to overexpression of NADPH oxidase, which generates more reactive oxygen species (ROS). These ROS damage DNA and lead to the development of cancer.

5. EYES

A cataract is the clouding of the eye's lens and is the leading cause of blindness worldwide. About 25 million people suffer from cataract blindness around the world, with the greatest incidence found in developing nations. The opacity of the eye lens limiting incoming light and resulting in visual impairment is known as a cataract. Although a variety of circumstances such as genetic factors, diabetes, age, smoking, pharmaceuticals, malnutrition, radiation (x-rays and UV rays), and disrupt endocrine and enzymatic equilibrium have been linked to cataract development.

The mechanism of cataractogenesis is not completely understood, but oxidative stress appears to play a significant role. Oxidative modification of lens proteins by free radicals leads to the formation of insoluble cross-linked products that scatter light, causing cloudiness and visual impairment. The main targets for oxidation in the lens are the -SH groups of glutathione (GSH), which act as a free radical scavenger and protect the lens against oxidative damage. Depletion of GSH in the lens due to oxidative stress results in loss of its ability to scavenge free radicals, leading to further damage and cataract formation.

In addition, lipid peroxidation induced by oxidative stress damages the cell membrane, causing leakage of lens proteins and other cellular constituents, which further contributes to cataractogenesis.

Oxidative stress has also been implicated in the development of age-related macular degeneration (AMD), which is the leading cause of blindness in industrialized nations. AMD is characterized by the loss of central vision due to damage to the macula, which is the small area at the centre of the retina that allows us to see fine details clearly. The exact cause of AMD is unknown, but it is thought to be a combination of genetic and environmental factors.

Oxidative stress is thought to play a role in the development of AMD, as there is an accumulation of oxidized lipids and proteins in the macula of patients with this condition. In addition, oxidative stress-induced damage to the retina and choroid (the layer of blood vessels that supplies the retina with oxygen and nutrients) leads to inflammation and the formation of new blood vessels, which can further damage the macula and lead to vision loss.

6. MUSCULOSKELETAL SYSTEM

Oxidative stress has been implicated in the development of osteoarthritis (OA), which is a degenerative disease of the joints. OA is the most common type of arthritis, and it affects about 27 million people in the United States alone. The symptoms of OA include pain, stiffness, and swelling of the joints.

The mechanism by which oxidative stress leads to the development of OA is not completely understood, but it is thought to be due to the damage caused by free radicals to the cartilage that covers the ends of bones. This damage leads to inflammation and the breakdown of cartilage, which eventually leads to joint pain and stiffness.

In addition, oxidative stress has been linked to the development of rheumatoid arthritis (RA), which is a chronic inflammatory disease of the joints. RA affects about 1% of the population worldwide, and its symptoms include joint pain, stiffness, and swelling. The pathogenesis of rheumatoid arthritis is through an autoimmune reaction in which the body's immune system attacks its own tissues. Oxidative stress is thought to play a role in the development of RA, as there is an accumulation of oxidized proteins and lipids in the joints of patients with this condition. In addition, oxidative stress leads to inflammation and the destruction of cartilage, which eventually leads to joint pain and stiffness.

7. PULMONARY SYSTEM

Respiratory diseases, such as respiratory distress syndrome, chronic obstructive pulmonary disease, chronic bronchitis, and asthma, are associated with free radicals. Asthma is one of the most prevalent lung disorders and is a significant worldwide health concern. It is characterized by persistent inflammation of the airways that causes variable and recurrent airflow obstruction along with bronchial hyperreactivity related to airway remodelling.

The process of airway remodelling is complex and involves different cell types, cytokines, and growth factors. Free radicals have been shown to be involved in all these processes. The role of free radicals in the pathogenesis of asthma has been extensively studied, and it is now clear that they are involved in both the acute and chronic phases of the disease.

In the acute phase, free radicals are thought to cause bronchoconstriction by inducing smooth muscle contraction. In the chronic phase, free radicals contribute to airway inflammation, which leads to airway remodelling.

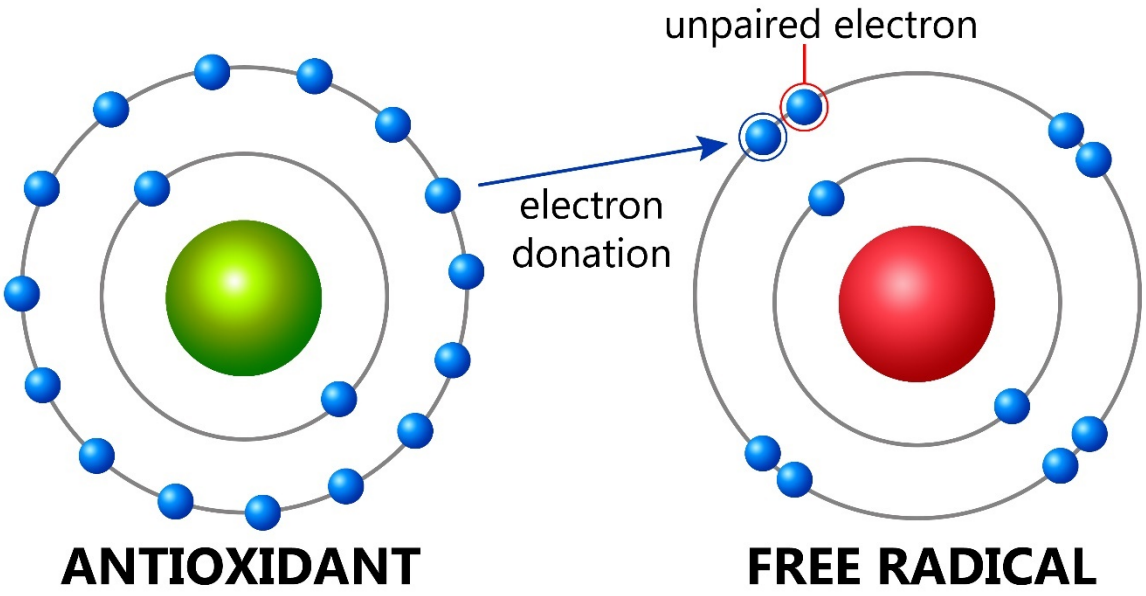
The most important sources of free radicals in asthma are inflammatory cells, such as neutrophils, eosinophils, macrophages, and mast cells. These cells release reactive oxygen species (ROS) and reactive nitrogen species (RNS), which contribute to the development of asthma.

The chapter has detailed how oxidative stress affects different systems in the body and how it can lead to chronic diseases. It is clear that oxidative stress poses a major threat to human health and more research is needed to understand its causes and effects in order to develop ways to prevent or treat its consequences.

One of the most potent systems for combatting oxidative stress is our own body's endogenous antioxidant system which works to destroy free radicals before they can cause cell damage and disease. While endogenous antioxidants can be very effective, it is also important to protect our bodies from external sources of oxidative stress by eating a diet rich in antioxidants and engaging in regular physical activity. In the next chapter, we will discuss how we can protect our bodies from oxidative stress by understanding the mechanisms of different antioxidants.

CHAPTER 4
ANTIOXIDANTS

How antioxidants reduce free radicals



chemically reactive unpaired electron + electron donation:
stable electron pair is formed, free radical is neutralised

An antioxidant is a chemical that can donate an electron to a free radical and neutralize it, thus reducing its ability to harm cells. These antioxidants mainly prevent or retard cellular damage through their free-radical scavenging capability. The low-molecular-weight antioxidants, such as vitamin C and glutathione, are water-soluble and easily distributed throughout the body. They reach every cell and protect it from oxidative damage. The high-molecular-weight antioxidants, such as vitamin E and carotenoids, are lipid-soluble and concentrate in membranes, where they protect cells from lipid peroxidation.

The role of antioxidants in human health was first recognized in the early 20th century when it was observed that certain vitamins could prevent or cure certain diseases.

Vitamin C was found to prevent scurvy, while vitamin A was found to prevent night blindness. In the 1940s, it was discovered that some enzymes could also act as antioxidants. These enzymes included superoxide dismutase, catalase, and glutathione peroxidase.

The discovery of the role of antioxidants in human health has led to a great deal of research into their potential health benefits. Antioxidants are thought to be beneficial in a number of different ways. They may help to protect against the development of certain chronic diseases, such as cancer and cardiovascular disease. They may also help to reduce the risk of other conditions, such as Alzheimer's disease and age-related macular degeneration.

The mechanism of action of antioxidants includes two principle actions. The first is chain-breaking. This is where an antioxidant donates an electron to a free radical, thus neutralizing it. The second mechanism is known as the prevention of oxidation. This is where an antioxidant prevents the oxidation of other molecules by scavenging free radicals before they have a chance to cause damage.

While the potential health benefits of antioxidants are still being studied, there is some evidence to suggest that they may be helpful in protecting against certain chronic diseases. For example, observational studies have shown that people who consume a diet high in antioxidants are at a lower risk of developing cancer (4). Antioxidants may also help to protect against cardiovascular disease by reducing the oxidation of low-density lipoprotein (LDL) cholesterol.

There are many different types of antioxidants, however, they are categorized into enzymatic and non-enzymatic antioxidants. Enzymatic antioxidants are enzymes that catalyze the conversion of reactive oxygen species into harmless products. Non-enzymatic antioxidants are small molecules that scavenge reactive oxygen species directly.

The most important enzymatic antioxidant is glutathione peroxidase, which is found in all cells. This enzyme catalyzes the reduction of hydrogen peroxide and organic hydroperoxides. Catalase is another important antioxidant enzyme, which is found in liver cells. This enzyme catalyzes the decomposition of hydrogen peroxide into water and oxygen.

Superoxide dismutase is a family of enzymes that catalyze the conversion of superoxide radicals into less reactive products. There are three types of superoxide dismutase enzymes: copper-zinc superoxide dismutase, manganese superoxide dismutase, and iron superoxide dismutase.

Non-enzymatic antioxidants include a variety of small molecules that scavenge reactive oxygen species directly. These antioxidants include glutathione, vitamin C, vitamin E, and carotenoids. Glutathione is a tripeptide that is synthesized in the liver. It functions as a coenzyme in many different biochemical reactions. Vitamin C is a water-soluble vitamin that is found in citrus fruits, leafy vegetables, and tomatoes. Vitamin E is a lipid-soluble vitamin that is found in vegetable oils, nuts, and seeds. Carotenoids are a group of pigments that are found in fruits and vegetables.

Flavonoids are a class of compounds found in plants that have been shown to have antioxidant activity. The most well-known flavonoids are quercetin, kaempferol, and myricetin. These compounds are thought to scavenge free radicals and protect cells from damage.

While all these antioxidants have different chemical structures, they all share one common mechanism of action: they donate electrons to reactive oxygen species, thus neutralizing them. Intake of anti-oxidants can occur through diet, supplements or medication.

However, the easiest and most effective manner is through hydrogen water. As we know, water composes 70% of our body so it is no surprise that by just drinking hydrogen water, we are able to increase the concentration of molecular hydrogen in various organs and tissues, neutralize oxygen free radicals and achieve a preventive or therapeutic effect on various diseases.

In the next sections, we'll go over the health benefits of molecular hydrogen in more detail.

CHAPTER 5
MOLECULAR HYDROGEN

Molecular hydrogen is a potent antioxidant that can scavenge free radicals and protect the body from their damaging effects. The properties that make molecular hydrogen the best antioxidant are its diverse scavenging ability, its small size, and its ability to cross the blood-brain barrier. Let's look at these properties in more detail.

NO TOXICITY

Molecular hydrogen is a safe, non-toxic gas that can be used as a therapeutic agent. There are no known side effects of drinking hydrogen water or inhaling hydrogen gas. In fact, molecular hydrogen has been shown to be protective against toxicity from other agents.

This can be traced to its trait of not having any by-product or side-effect, being the lightest element (and thus easily excreted), and because it is an antioxidant that selectively reduces only the most harmful ROS.

For instance, the reaction of H2 with superoxide produces water, whereas the reaction of H2 with hydroxyl radical produces harmless molecular oxygen. This is in contrast to other antioxidants that may be effective in reducing one type of ROS but can also generate other harmful ROS in the process (e.g., by-products of ascorbate-superoxide reaction).

BIOAVAILABILITY

Molecular hydrogen is very soluble in water and is rapidly absorbed from the gastrointestinal tract into the bloodstream. Once in the blood, it can diffuse into all tissues and organs, including the brain. The neutral charge of molecular hydrogen also allows it to cross the blood-brain barrier and enter the brain tissue.

The small size of molecular hydrogen makes it able to penetrate into all cells and tissues of the body, including mitochondria. This is important because many diseases are associated with mitochondrial dysfunction. Comparing molecular hydrogen with other antioxidants, such as vitamin C and glutathione, it is superior because of its small size and ability to directly enter cells and mitochondria.

Vitamin C for instance is a water-soluble antioxidant that scavenges free radicals in the extracellular space, but cannot enter cells or mitochondria. Glutathione is a potent antioxidant that is produced endogenously and is found in almost every cell in the body, but it is mostly confined to the intracellular space and cannot easily cross cell membranes.

The light and small molecular weight of molecular hydrogen also allow it to rapidly diffuse across membranes and reach areas in the body that are otherwise difficult for other antioxidants to access. The fact that molecular hydrogen can reach all cells and tissues in the body makes it a very powerful antioxidant.

SELECTIVITY

Selectivity is one of molecular hydrogen's most important physiological properties. This gas can selectively reduce harmful hydroxyl radicals while leaving beneficial radicals, such as those involved in cellular signalling, untouched. As a result, molecular hydrogen has the potential to serve as an effective therapy for a wide range of diseases that are caused by oxidative stress.

Only targeting cytotoxic or genotoxic reactive oxygen species (ROS) would be an advantage over other antioxidants, because these ROS are thought to be the main cause of oxidative stress-related diseases, whereas the beneficial signalling ROS are essential for normal cellular function.

In support of this idea, numerous in vitro and animal studies have shown that molecular hydrogen can scavenge a variety of harmful ROS, including hydroxyl radicals, peroxynitrite, and hypochlorous acid. These studies have also demonstrated that molecular hydrogen can protect cells and tissues from oxidative damage (5). In addition, a number of clinical trials have shown that drinking hydrogen-rich water can improve various markers of oxidative stress in humans.

One of the most well-known effects of molecular hydrogen is its ability to scavenge hydroxyl radicals. Hydroxyl radicals are the most reactive and damaging type of ROS, and they are thought to be responsible for the majority of oxidative damage that occurs in the body.

Now let's look at some benefits on the physiological level.

We've already discussed the anti-oxidant and selective properties of molecular hydrogen, the following three points focus on benefits that have been shown in various studies.

REGULATION OF MITOCHONDRIA

The importance of the H2 depleting antioxidant pathway in cellular energy production is immense. Mitochondria are often referred to as the cells' powerhouses since they generate 90% of the cell's ATP through oxidative phosphorylation. In this process, electrons are transferred from substrates to oxygen by a series of electron carriers in the mitochondrial inner membrane. The resulting proton gradient across the mitochondrial inner membrane drives the synthesis of ATP from ADP and Pi.

The H2 molecule prevents uncontrolled electron leakage from the electron transport chain and is anticipated to have the capacity to restore cell damage. Molecular hydrogen also has the ability to regulate mitochondrial biogenesis. Sirtuins are a class of enzymes that can deacetylate proteins and have been implicated in the regulation of mitochondrial biogenesis. Studies have shown that molecular hydrogen can increase the activity of SIRT1, which is known to be involved in the control of mitochondrial function and energy metabolism (6).

Co-enzymes Q10 (CoQ10) is an important electron carrier in the mitochondrial respiratory chain and is also a potent antioxidant. CoQ10 levels have been shown to decrease with age and its supplementation has been shown to be beneficial in the treatment of age-related diseases such as heart disease and Parkinson's disease. Molecular hydrogen has also been shown to increase CoQ10 levels, suggesting that it may have potential therapeutic benefits in treating these age-related diseases.

Mitophagy is a process of selective degradation of damaged mitochondria by autophagy. This process is important for the maintenance of mitochondrial homeostasis and ensures that only functional mitochondria are present in the cell. Molecular hydrogen in this instance functions as an “off switch” for mitophagy.

Lastly, the ATP channels of mitochondria are the pores that regulate the transport of ATP molecules out of mitochondria. These channels are also known to be involved in the release of mitochondrial pro-apoptotic factors. Studies have shown that molecular hydrogen can inhibit the opening of ATP channels, thus preventing the release of these pro-apoptotic factors and protecting cells from apoptosis (7).

ANTI-INFLAMMATORY EFFECT

Inflammation is a complex biological response to various stimuli, including pathogens, damaged cells, and irritants. It is a vital process that helps the body heal and protects itself from further damage. However, chronic inflammation can lead to a host of diseases and conditions, such as heart disease, cancer, and arthritis.

The anti-inflammatory effect of molecular hydrogen has been well documented in both animal and human studies. Studies have shown that molecular hydrogen can inhibit the production of pro-inflammatory cytokines, such as TNF-α, IL-1β, and IL-6. It can also modulate the activity of immune cells, such as macrophages and lymphocytes (8).

One of the mechanisms by which molecular hydrogen exerts its anti-inflammatory effect is through the downregulation of NF-κB, a transcription factor that plays a key role in inflammation. Studies have shown that molecular hydrogen can inhibit the activation of NF-κB, thus reducing inflammation (8).

In acute inflammation, neutrophils are the first line of defence against invading pathogens. These immune cells produce reactive oxygen species (ROS) to kill the invading pathogens. However, excessive production of ROS by neutrophils can damage host tissue, leading to chronic inflammation. Studies have shown that molecular hydrogen can reduce the production of ROS by neutrophils, thus reducing the risk of chronic inflammation (8). In the early stage, molecular hydrogen downregulates the expression of genes involved in the production of ROS. In the later stage, it upregulates the expression of antioxidant enzymes, such as glutathione peroxidase and catalase, which scavenge ROS and protect cells from damage.

Heme-oxygenase-1 (HO-1) is an enzyme that catalyzes the breakdown of heme, a pigment that gives blood its red colour. Heme is toxic when present in excess and can damage cells and tissues. HO-1 plays a key role in the detoxification of heme and its over-expression has been shown to protect cells from heme-induced oxidative stress. Studies have shown that molecular hydrogen can upregulate the expression of HO-1, thus providing protection against oxidative stress (9).

CELL DEATH REGULATION

Cell death occurs by two apoptosis, autophagy and pyrolysis.

Apoptosis is a type of cell death that is characterized by cell shrinkage, chromatin condensation, and DNA fragmentation. These changes occur in response to various stimuli, such as growth factor withdrawal, UV radiation, and chemotherapeutic drugs. Apoptosis is a vital process that helps the body rid itself of damaged or unwanted cells. However, uncontrolled apoptosis can lead to a number of diseases, such as cancer.

Autophagy is another type of cell death that involves the degradation of cellular components by lysosomes. Autophagy plays an important role in the maintenance of cellular homeostasis and protects cells from stress-induced damage. like apoptosis, autophagy is also a vital process that helps the body rid itself of damaged or unwanted cells.

Pyrolysis is a type of cell death that is characterized by the release of inflammatory mediators, such as cytokines and chemokines. Unlike apoptosis and autophagy, pyrolysis does not involve the degradation of cellular components.

Molecular hydrogen has been shown to protect cells from all three types of cell death.

In apoptosis, molecular hydrogen inhibits the activation of caspases, enzymes that mediate cell death. Molecular hydrogen has also been shown to downregulate the expression of pro-apoptotic genes and upregulate the expression of anti-apoptotic genes. In autophagy, molecular hydrogen inhibits the formation of autophagosomes, organelles that are essential for autophagy. Molecular hydrogen has also been shown to downregulate the expression of autophagy-related genes. In pyrolysis, molecular hydrogen inhibits the release of inflammatory mediators from cells.

As a result of its ability to protect cells from all three types of cell death, molecular hydrogen has been shown to have therapeutic potential in a wide range of diseases.

IMMUNE SYSTEM

The immune system is the body's natural defence against infection and disease. It is made up of a network of cells, tissues, and organs that work together to protect the body from foreign invaders.

CD4+ T cells are a type of white blood cell that plays a central role in the immune response. These cells are responsible for recognising foreign invaders and triggering an immune response. By downregulating the production of pro-inflammatory cytokines, CD4+ T cells help to prevent the body from overreacting to foreign invaders.

Likewise, in immunodeficient individuals, particularly those with autoimmune diseases, CD8+ T cells are thought to play a role in the pathogenesis of these conditions. Molecular hydrogen increases the production of regulatory T cells, which are a type of white blood cell that helps to keep the immune response in check.

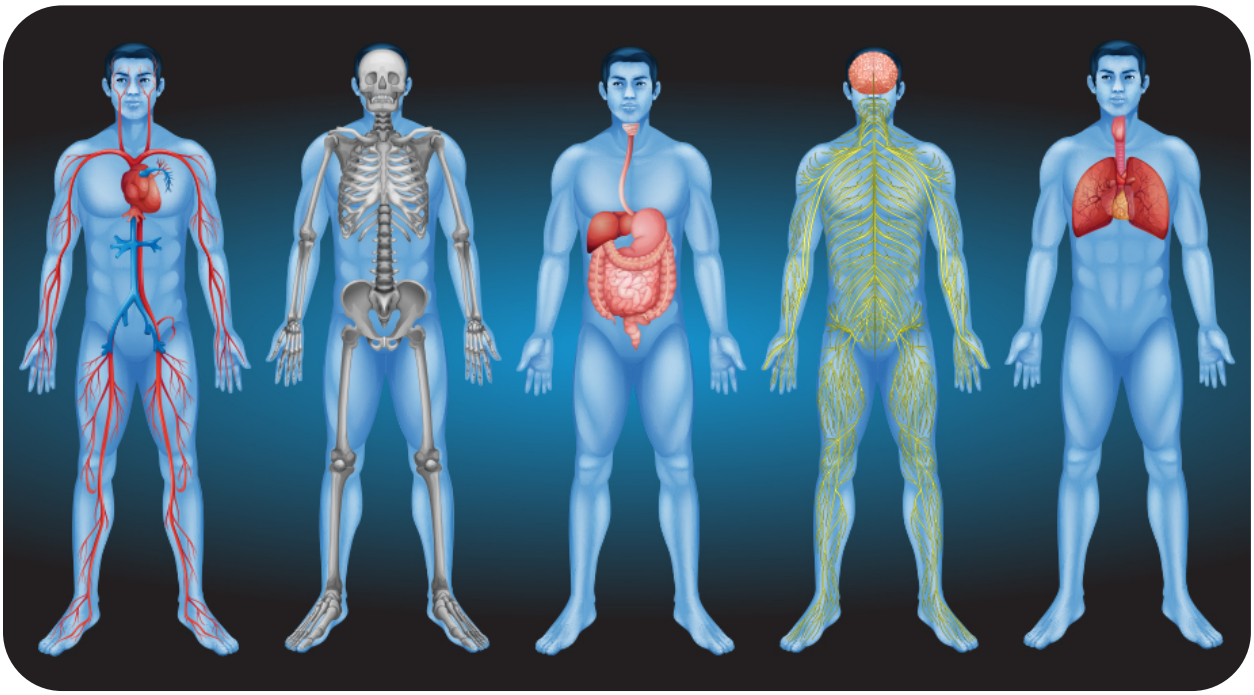
Molecular hydrogen has been shown to modulate the immune system by downregulating the production of pro-inflammatory cytokines. Molecular hydrogen was found to reduce the levels of pro-inflammatory cytokines such as interleukin-1β (IL-1β), interleukin-6 (IL-6), and tumour necrosis factor-α (TNF-α) in the blood. This suggests that molecular hydrogen may help to prevent the overreaction of the immune system to foreign invaders.

Molecular hydrogen has been shown to be an effective antioxidant in a number of studies. It can scavenge free radicals and protect the body from their damaging effects. Additionally, molecular hydrogen appears to have therapeutic benefits for a variety of diseases. More research is needed to determine the full extent of these benefits, but the early evidence is promising.

While the effects are visible on the cellular and molecular levels, molecular hydrogen's antioxidant and anti-inflammatory properties may also help to improve the overall health of an individual. This becomes even more pronounced as we shift to a macro view and the impact on various systems in the body, such as the immune system. As we continue to learn more about this exciting compound and its benefits, it may become an important component in a variety of treatment regimens. The next chapter looks at the macro effects of molecular hydrogen, including its effects on the immune system.

CHAPTER 6

HEALTH BENEFITS OF HYDROGEN WATER



Hydrogen water has been shown to offer a variety of health benefits, including improved digestion, reduced inflammation, and increased energy levels.

One of the most well-known benefits of hydrogen water is its ability to improve digestion. This is because hydrogen water can help to break down food more effectively, making it easier for your body to absorb the nutrients it needs. Hydrogen water has also been shown to reduce inflammation in the digestive system, which can lead to better overall health.

Hydrogen water has also been shown to increase energy levels. This is likely due to the fact that hydrogen water can help to improve oxygenation in the blood, which can help to increase stamina and endurance. Additionally, hydrogen water can help to improve cognitive function and memory.

Let's look at detailed benefits and mechanism of action for each organ and system:

NEUROPROTECTION

Neurodegenerative diseases are those that lead to the progressive loss of structure or function of neurons, which are the cells that make up our nervous system. These diseases include Alzheimer's disease, Parkinson's disease, Huntington's disease, and amyotrophic lateral sclerosis (ALS). There is evidence to suggest that hydrogen water can help to protect against these conditions.

In Parkinson's for instance, damaged mitochondria are thought to be a major contributing factor. Hydrogen has been shown to improve mitochondrial function, and thus it is possible that it could help to protect against or even reverse some of the damage seen in Parkinson's. The dopaminergic neurons in the substantia nigra are particularly vulnerable in Parkinson's, and these neurons have been shown to be protected by hydrogen water.

In Alzheimer's disease, there is evidence to suggest that hydrogen water can help to reduce the formation of amyloid plaques. These plaques are made up of a protein called beta-amyloid, and they are thought to play a role in the development of Alzheimer's. Hydrogen has been shown to reduce the production of beta-amyloid, and it is thought that it could also help to clear existing plaques.

In Huntington's, hydrogen water has been shown to decrease oxidative stress and cell death. In ALS, hydrogen-rich saline has been shown to improve muscle strength and reduce inflammation. There is also some evidence to suggest that hydrogen water can help to protect the brain after a stroke. Rats that were given hydrogen-rich saline immediately after a stroke had less brain damage and fewer neurological deficits than those that were not given hydrogen.

Dementia is a general term used to describe a decline in cognitive function. It can be caused by a number of different conditions, including Alzheimer's disease, Parkinson's disease, and stroke. There is some evidence to suggest that hydrogen water can help to improve cognitive function in people with dementia.

Even depression can be treated by drinking hydrogen water. The theory is that by drinking hydrogen water, you can increase the levels of serotonin and dopamine in your brain. These are two of the main neurotransmitters that are thought to be involved in depression.

In summary, hydrogen water has been shown to offer neuroprotection against a variety of conditions, including Alzheimer's disease, Parkinson's disease, Huntington's disease, and amyotrophic lateral sclerosis (ALS). Additionally, it has been shown to improve cognitive function in people with dementia and reduce depression.

CARDIOVASCULAR PROTECTION

The cardiovascular system includes the heart and blood vessels. Hydrogen water has been shown to offer protection against a variety of cardiovascular conditions, including heart disease, stroke, and high blood pressure.

The buildup of plaque in the arteries (a condition called atherosclerosis) is a major risk factor for heart disease. Plaque is made up of cholesterol, fat, and other substances in the blood. Hydrogen water has been shown to reduce plaque buildup in the arteries and improve blood flow. It does this by reducing inflammation and oxidative stress, two major contributors to plaque formation.

Hydrogen water has also been shown to reduce the risk of stroke. A stroke occurs when a blood vessel in the brain becomes blocked or bursts. This can lead to brain damage or even death.

However, the most significant use of hydrogen water and molecular hydrogen is in reperfusion injury. Reperfusion injury is a type of damage that occurs when blood flow returns to an area that has been deprived of oxygen, such as the heart after a heart attack.

When blood flow is restored, there is a sudden influx of oxygen into the tissue. This can cause oxidative stress, which can damage cells and lead to further problems. Studies have shown that hydrogen water can protect against reperfusion injury by reducing oxidative stress (10). Therefore in cases of myocardial or cerebral infarction, the benefits of hydrogen water are twofold. Not only does it prevent further damage, but it also helps the damaged tissue to repair and regenerate.

Even after an organ transplant, reperfusion injury is a major concern. When a new organ is transplanted, the blood supply must be re-established. This can cause oxidative stress and damage to the cells of the new organ. Again hydrogen water has been shown to protect against this type of damage.

In addition to its protective effects, hydrogen water has also been shown to improve the function of the cardiovascular system. Studies have shown that it can increase exercise capacity and reduce fatigue (10). It does this by improving blood flow and oxygen utilization in the body.

METABOLIC SYNDROME

A metabolic syndrome is a group of conditions that increase your risk of developing heart disease, stroke, and type 2 diabetes. These conditions include high blood pressure, high blood sugar, and excess body fat around the waist.

The pathophysiology behind metabolic syndrome is linked to fat accumulation in the liver and pancreas, which leads to insulin resistance. This, in turn, causes elevated levels of glucose and fats in the blood. Several studies have shown that hydrogen water can help improve metabolic syndrome by reducing fat accumulation in the liver and pancreas and improving insulin sensitivity.

In a study of humans with metabolic syndrome, those who drank hydrogen-rich water for 24 weeks had significant improvements in waist circumference, fasting blood sugar, and insulin resistance, compared to those who did not drink hydrogen water (11).

These studies suggest that drinking hydrogen water may help improve metabolic syndrome by reducing fat accumulation in the liver and pancreas and improving insulin sensitivity.

Cholesterol is a type of fat that is essential for our body to function properly. However, too much cholesterol can lead to heart disease. There are two main types of cholesterol: low-density lipoprotein (LDL), which is the “bad” cholesterol, and high-density lipoprotein (HDL), which is the “good” cholesterol.

Hydrogen water has been shown to help improve cholesterol levels by reducing LDL cholesterol and increasing HDL cholesterol. In a study of rats with high cholesterol, those that were given hydrogen water had significantly lower levels of LDL cholesterol and higher levels of HDL cholesterol than those that were not given hydrogen water (12). By reducing the levels of LDL cholesterol and increasing the levels of HDL cholesterol, hydrogen water can help to reduce the risk of metabolic syndrome and heart disease.

AUTOIMMUNE DISEASES

Hydrogen has been shown to be a therapeutic agent in the treatment of autoimmune diseases, such as rheumatoid arthritis, Crohn's disease, and multiple sclerosis. In a study on rats with experimental autoimmune encephalomyelitis (EAE, an animal model for multiple sclerosis), it was found that administration of hydrogen-rich saline alleviated the symptoms of EAE and reduced the production of pro-inflammatory cytokines.

In another study, it was found that hydrogen-rich water improved the symptoms of rheumatoid arthritis in rats by reducing the levels of pro-inflammatory cytokines and by inducing an anti-inflammatory response (13). Additionally, research on active Crohn's disease found that drinking hydrogen-rich water led to a significant reduction in the severity of symptoms and improved quality of life (14).

MITIGATION OF CANCERS

Cancer is a disease characterized by the abnormal growth of cells. There are many different types of cancer, each with its own set of symptoms and treatment options.

Hydrogen has been shown to have cytotoxic effects on cancer cells, meaning that it can kill cancer cells without harming normal cells. In human lung cancer cells, it was found that hydrogen-rich water was able to kill the cancer cells without harming the normal cells. In another study, it was found that drinking hydrogen-rich water improved the survival rate of rats with pancreatic cancer. This suggests that hydrogen-rich water may help to improve the prognosis of patients with pancreatic cancer.

Hydrogen-rich water has been shown to help reduce the risk of breast cancer. In a study on rats, it was found that those that were given hydrogen-rich water had significantly lower levels of a type of estrogen known to be associated with an increased risk of breast cancer, compared to those that were not given hydrogen water. Additionally, another study found that drinking hydrogen-rich water led to a significant reduction in the number of breast cancer cells in rats.

Colon cancer is the third most common type of cancer in the world. Hydrogen-rich water has been shown to help reduce the risk of colon cancer. In a study on rats, it was found that those that were given hydrogen-rich water had significantly lower levels of a type of inflammation known to be associated with an increased risk of colon cancer, compared to those that were not given hydrogen water.

The overall mitigation of cancers seen in studies with rats suggests that hydrogen-rich water may help to reduce the risk of cancer in humans. Human trials are underway to further investigate this potential benefit.

MITOCHONDRIAL DISEASES

Mitochondrial myopathies and dermatomyositis are two examples of mitochondrial diseases that can be improved by drinking hydrogen water. Both the conditions are characterized by muscle weakness and inflammation. In a study done on rats, it was found that those that were given hydrogen water had improved symptoms and reduced inflammation.

In another study on humans, it was found that those with mitochondrial myopathies who drank hydrogen water for 6 months had improvements in their condition. They had less fatigue, a better quality of sleep, and improved exercise tolerance. As explained in the previous chapter, molecular hydrogen can help to protect our cells and mitochondria from damage. This is one of the ways in which it can help improve mitochondrial diseases.

HEMODIALYSIS

Hemodialysis is a treatment for kidney failure that involves filtering the blood to remove toxins and excess fluid. It is typically done 3 times a week for 4 hours each time.

In a study on hemodialysis patients, it was found that those who were given hydrogen-rich water had significantly lower levels of inflammation and oxidative stress, compared to those who were not given hydrogen water. Additionally, another study found that drinking hydrogen-rich water led to improved quality of life in hemodialysis patients. These studies suggest that hydrogen-rich water may help to improve the symptoms of those with kidney failure.

The process of hemodialysis can lead to the loss of minerals from the body, such as calcium. In a study on rats, it was found that those that were given hydrogen-rich water had significantly higher levels of calcium in their bones, compared to those that were not given hydrogen water. This suggests that hydrogen-rich water may help to prevent the loss of minerals from the body during hemodialysis.

EXERCISE

Exercise and fatigue are characterized by lactic acid accumulation in the muscles. In a study on rats, it was found that those that were given hydrogen-rich water had significantly lower levels of lactic acid in their muscles, compared to those that were not given hydrogen water. This suggests that hydrogen-rich water may help to reduce fatigue during exercise.

In another study, it was found that drinking hydrogen-rich water led to improved recovery from exercise-induced muscle damage. This is likely due to the fact that molecular hydrogen can help to protect our cells and mitochondria from damage.

The increased and efficient mitochondrial functioning following the consumption of hydrogen water may also help to improve athletic performance. This leads to lesser build up of lactic acid and more efficient removal of it from the muscles, resulting in improved athletic performance.

SKIN CONDITIONS

The skin is our largest organ and is constantly exposed to environmental stressors that can damage it. These include ultraviolet (UV) radiation from the sun, pollution, and smoke.

It was found that drinking hydrogen-rich water led to improved symptoms in those with atopic dermatitis, a type of skin condition characterized by dryness, itching, and inflammation. These suggest that hydrogen-rich water may help to improve the symptoms of atopic dermatitis. In another study, it was found that drinking hydrogen-rich water led to a significant increase in skin moisture and a decrease in inflammation. Additionally, another study found that hydrogen-rich water led to improved wound healing. These studies suggest that hydrogen-rich water may help to improve the condition of the skin.

The collagen in our skin helps to keep it elastic and youthful-looking. As we age, our collagen levels decrease, leading to wrinkles and sagging skin. This is mainly due to oxidative stress and inflammation.

A study found that those who were given hydrogen-rich water had significantly higher levels of collagen in their skin, compared to those who were not given hydrogen water. This suggests that hydrogen-rich water may help to prevent the loss of collagen from the skin.

Now that we have explored the health benefits of hydrogen water, it is important to consider how you can make this beneficial drink a part of your daily routine. Hydrogen water has been shown to improve overall health and well-being, so adding it to your diet is a great way to support your body's systems.

CHAPTER 7

HOW TO TAKE MOLECULAR HYDROGEN

Molecular hydrogen is a powerful antioxidant that can help protect the body against disease and aging. There are several ways to take molecular hydrogen, including drinking hydrogen water, inhaling hydrogen gas, or taking molecular hydrogen supplements.

Hydrogen water is water that has been infused with molecular hydrogen. This is by far the most popular way to take molecular hydrogen, as it is easy and convenient. There are several ways to get hydrogen water, including buying a counter-top machine that makes it, using a portable hydrogen generator, or buying prepackaged hydrogen water.

A counter top machine is a great way to have a steady supply of hydrogen water. There are several different brands on the market, and they all work similarly.

Basically, you fill up the machine with water, and it uses electrolysis to infuse the water with hydrogen gas. The hydrogen gas is then dissolved into the water, making it “hydrogen-rich”.

A portable hydrogen generator is a great option if you want to take hydrogen water on the go. These generators use electrolysis to infuse water with hydrogen gas, just like the counter top machines. However, they are much smaller and more convenient for travel.

Prepackaged hydrogen water is another easy way to get your daily dose of molecular hydrogen. These bottles of water have already been infused with hydrogen gas, so all you have to do is drink it. This is a great option if you don’t want to hassle with making your own hydrogen water.

Saline infusion is a process where molecular hydrogen is infused into saline solution and then injected into the body. This is a more invasive way to take molecular hydrogen, and is typically only done by medical professionals.

In addition to drinking hydrogen water, you can also inhale hydrogen gas or take molecular hydrogen supplements.

Inhaling hydrogen gas is a great way to get a concentrated dose of molecular hydrogen. There are several different devices on the market that allow you to do this, such as the H2 Inhaler or the H2 Vitalizer.

Molecular hydrogen supplements are another option for taking molecular hydrogen. These supplements typically come in tablet or capsule form, and they are taken orally. There are several different brands on the market, so be sure to do your research to find one that is right for you.

Hydrogen bath is a form of therapy that uses molecular hydrogen to help the body heal. This therapy is typically done in a special tub that allows you to inhale hydrogen gas while you soak in water. Hydrogen gas is also dissolved into the water, making it “hydrogen-rich”. This therapy can be done at home or at a special hydrogen bath facility.

No matter which method you choose, taking molecular hydrogen is a great way to improve your health and protect your body against disease and aging.

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