

PHARMACEUTICAL AND MEDICINAL PROPERTIES OF GLUTATHIONE: AN OVERVIEW

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ABSTRACT

Objective: Glutathione is an antioxidant, which presents in mammalian and known as the most powerful antioxidant. Glutathione is called as "Master Antioxidant" because of its intracellular and possesses the aptitude to exploit the performance of other antioxidants, these include vitamins C & E, CoQ10 (ubiquinone) and alpha-lipoic acid, and rich in fresh vegetables and fruits. **Conclusion:** The major role of Glutathione is to protecting cells and mitochondria from oxidative and peroxidative damage also needed for cleansing, energy utilization, reduction of aging-associated diseases, elimination of toxins from the cells, and protection from the damaging effects of radiation, chemicals, and environmental pollutants. Our body's ability to produce glutathione decreases as you age. This review suggests that Glutathione can recommend as the best therapeutic agent in pharma industries and skin-lightening agent in cosmetic industries.

Keywords; Glutathione, Antioxidant, Depression, Stress, Anti-aging, cell death.

INTRODUCTION

Glutathione (GSH) is an antioxidant in the plant, animals, fungi and some bacteria and Achaea. It is a tripeptide with a gamma peptide linkage between the carboxyl group of the glutamate side chain and the amine group of cysteine, and the carboxyl group of cysteine is attached by a normal peptide linkage to a glycine and most abundant non-protein thiol; it can defend from oxidative stress [1]. GSH is a key contributor to a widespread biotic action, such as immune regulation, detoxification. GSH has been used in pharmaceuticals, cosmetics, and food industries [2], [3].

Medicinal properties of glutathione

Oxidative Stress in the Body

Glutathione can prevent cellular components from reactive oxygen species (ROS), and these oxygen species can cause to damage to cells components which include nucleic acids [12],[13],[14]. This antioxidant defends, contrary to chronic oxidative stress that can cause cancer, neurodegeneration, etc. [12]. As well, and neutralizing reactive oxygen species (ROS), it is essential for the redevelopment of other antioxidants, such as vitamins C and E [15].

Switch Tenderness

Glutathione inhibits the synthesis of inflammatory cytokines [16]. Deficiency of glutathione causes swells in the respiratory tract of rats. This inflammation reduced when treated with glutathione to mice [17]. In addition, inhibits NF- κ , a transcription factor that increases the transcription of various inflammatory genes [18]. The numbers of lung diseases caused by extreme infection. In various diseases, restoring glutathione to a vigorous level is protective, incidentally supporting the idea that glutathione is anti-inflammatory [19].

Anti-Aging

With less when glutathione is less, the free radicals can harm the body and causes aging. Imbalances of glutathione level affect the function of the immune system and aging process of the cells. [20], [21].

Glutathione drops off during climacteric, which may part of the reason for the dramatic aging that occurs in the biological time of woman [22]. By preserving glutathione levels, aging individuals may prevent age-related cognitive decline [23]. Reduced levels of

Glutathione in aging themes cause oxidative stress, Can cause bone disease [24]. Myricitrin it's a drug used for treat age-related osteoporosis, and may help to raise the level of glutathione [25].

Misery and Pressure

When there is a low level of glutathione can cause depression in patients [26],[27]. Glutathione used to treat shock-induced behavioral depression in animals [28]. Studies showed that a drug Alprazolam used to treat stress, raise levels of Glutathione in the mice [29].

Limit Neurodegeneration

The neuron cells consume about 20% of the oxygen used by the body. But consumed only 2% of the body's weight. Reactive oxygen species are constantly produced during oxidative metabolism. As a result, the detoxification of reactive oxygen species is an essential task within the brain. Glutathione plays a key role in this process [30].

- Alzheimer's disease: In partially Alzheimer's disease also caused by the oxidative stress that antioxidants neutralize, as showed by clinical studies showed that oral vitamin E (a powerful antioxidant) uptake slowed the progression of Alzheimer's [31], [32]. To make matters worse, Alzheimer's is characterized by the accumulation of TDP-43 (a DNA binding protein) in the nervous system can further lower Glutathione levels (20). In mice, a protein that increases Glutathione levels in the body was found to increase memory in subjects with Alzheimer's [31].
- Parkinson's disease: Parkinson's disease moderately caused by oxidative stress in the nervous system. Glutathione combats this oxidative stress [32]. Parkinson's disease involves the loss of dopaminergic neurons in the substantianigra part of the brain. Has been studied that people in preclinical stages of Parkinson's have low Glutathione levels in the substantianigra [33]. A study showed that a drug named 3, 4-dihydroxy benzalacetone, helped prevent Parkinson's disease by increasing levels of Glutathione [33].
- Huntington's disease: Huntington's disease is affected by oxidative stress and mitochondrial dysfunction. Studies have shown that a special form of curcumin successfully helped

improve mitochondrial health by increasing Glutathione levels [34].

Infections

Viral Infections cause abnormal amounts of oxidative stress in cells because of inflammation and a reduction of Glutathione levels [35], [36]. In many diseases (e.g., AIDS, COPD, cystic fibrosis, influenza, and alcoholism), lowered immunity and increased risk of infections correlate with low Glutathione levels [36]. Patients with tuberculosis have shown to have low Glutathione levels [36]. Glutathione depletion lowers the anti-infectious activity of macrophages while NAC (Glutathione precursor) increased intracellular killing of mycobacteria [37]. Another study showed that the maintenance of cysteine levels, and thus Glutathione levels, is important for enhancing mycobacterial killing the activity [38].

Heal the Gut

Patients with IBS have decreased the activity of enzymes involved in Glutathione synthesis, and lower levels of Glutathione's precursor, cysteine [39]. Glutathione peroxidase is an important enzyme for the normal renewal of the gut wall [40]. Glutathione protects the intestinal mucosa. Administration of Glutathione may protect the gut wall that, when weakened, can lead to leaky gut [41].

Treat Autism

Children diagnosed with Autism have lower levels (20-40% lower) of reduced Glutathione than considered normal [42], [43]. Other abnormalities have found in the trans-sulfuration pathway (the pathway where Glutathione is produced) in children diagnosed with Autism [43]. This includes lower levels of Cysteine, the rate-limiting substrate for Glutathione production [44]. In Autistic children, to maintain the level of glutathione by using oral and transdermal glutathione. Early studies indicate that this may improve some trans-sulfuration metabolites often low in autistic children [44].

Glutathione and Cancer

Glutathione is a major factor in regulating life, proliferation, and death of cancer cells [45]. Glutathione deficiency, or a decrease in the Glutathione/Glutathione disulfide (GSSG) ratio, leads to increased damage from oxidative stress involved in the progression of cancer [46]. There is a significant correlation between increased Glutathione intake and decreased risk of oral and throat cancer [47].

Glutathione plays a key role in repairing the damage from cancer drugs on cells in chemotherapy patients [48]. Glutathione is a vital role in the removal and detoxification of carcinogens by conversing conflict to several chemotherapeutic drugs; elevated levels of Glutathione can protect cancer cells. You need to get the balance right [49], [50].

Treat Psychiatric Disorders

Schizophrenics have low levels of Glutathione. NAC, which increases Glutathione levels in the brain, has shown to improve the symptoms of schizophrenia in human subjects [51]. Patients have low levels of Glutathione in certain parts of their brain due to Obsessive Compulsive Disorder (OCD) (e.g., lower posterior cingulate cortex) [52]. Patients with OCD, having high levels of free radicals in their blood. Reducing these levels by introducing Glutathione may help reduce the severity of OCD symptoms [53].

Glutathione may help to reduce stress, which is a major symptom and possibly a contributing factor, of OCD [54]. Multiple drugs used to treat bipolar disorder work by increasing Glutathione levels [55].

Increasing Glutathione Levels May Help ADHD

Subjects with ADHD have shown to have low Glutathione and high levels of oxidative stress [56]. Pycnogenol, a Glutathione booster, has found to normalize antioxidant levels in children with ADHD [57].

Preventing Heart Disease

Low activity of Glutathione peroxidase and low levels of systemic and cardiac Glutathione, is linked with an increased risk with a heart attack [58], [59], [60]. Cardiovascular disease is mostly caused by oxidative stress in heart tissues. For conditions such as insulin resistance, impaired glucose tolerance, and diabetes caused oxidative stress in heart tissue and are linked to heart attacks [60], [61]. Glutathione can help in reducing these reactive species and limit the risk of stroke or heart attack [62].

Treat Diabetic Complications

Diabetes II and high blood sugar reduce Glutathione in the body [63]. Free radical accumulation causes many of the complications associated with diabetes II, such as cardiovascular problems and neurological disorders. Introducing extra Glutathione into the body has shown to prevent, or at least limit, these complications [63].

Prevent Kidney Disease

Oxidative stress in the kidneys can cause kidney failure [64]. Studies in rats have shown that the precursor of Glutathione, NAC can prevent kidney disease because of aspartame [64]. Misery from chronic renal failure and undergoing hemodialysis found that supplemental Glutathione resulted in a marked improvement in kidney function [65].

Protects Against Liver Damage

Liver disease caused by oxidative stress. Glutathione can keep the liver healthy by helping in reducing this oxidative stress in the liver [66]. Glutathione plays an important role in the liver in detoxification reactions and in controlling the thiol-disulfide status of the cell [67]. The liver upregulate Glutathione synthesis to combat the effects of a high-fat diet [67]. Oral administration of reduced Glutathione (300mg/day) is effective at preventing non-alcoholic fatty liver disease, which can eventually lead to cirrhosis and liver cancer [68].

Prevent Addiction

Consumption of cocaine, methamphetamines, and alcohol lead to increased production of reactive oxygen species (ROS) [69]. These species can change proteins complicated in neuronal and behavioral pathways, causing the subject to become addicted. By reducing these reactive species, Glutathione may decrease the development of addictive behaviors [70]. This may also apply to overeat disorders [71].

Reduce the Consequences of Drugs or Alcohol

Chronic alcohol use causes oxidative stress and reduces liver levels of Glutathione. Glutathione can reduce the effects of chronic use by decreasing reactive oxygen species (ROS) [72]. Glutathione enhanced the liver function of alcoholics, but only when they withdraw from alcohol use. Glutathione reduces the level of alcohol, acetaldehyde and hepatic triglyceride in the blood. Chronic alcohol ingestion causes oxidative stress in the lungs, which can often lead to respiratory infections such as pneumonia. Glutathione can protect the lungs by reducing oxidative stress [73].

Controls Cell Death

Glutathione is a key to reduction signaling event that controls the activation of cell death pathways. [74], [75]. Cells exhausted of Glutathione is at risk of damage, especially from arachidonic acid. Studies have shown that low Glutathione levels cause a series of events, which ultimately result in cell death [76].

Respiratory Issues

Increased inflammation and caused asthma in the airway because of lack of Glutathione. The same study showed that increasing levels of Glutathione decreased inflammation and reduced asthma in the airway [77]. Chronic Obstructive Pulmonary Disease (COPD) is caused by longstanding oxidative damage to lung tissue, the damage of which results in inflammation of the

lung tissue, causing shortness of breath and coughing. Glutathione supplements can decrease this oxidative damage and tissue damage within the lungs, reducing the risk of developing COPD [78].

Treat Sleep Apnea

Patients with sleep apnea have extraordinary of oxidative stress and depleted glutathione ranks [79]. Who was diagnosed with sleep apnea because of the low level of Glutathione, and that increasing those levels of Glutathione to normal improved sleep quality in these patients [80]

Treat Acne

The extraordinary level of oxidative stress leads to stumpy levels of Glutathione in Acne patients [81], [82]. A decline in anti-oxidative activity, especially a reducing in glutathione quantity, may play a key role in the development of acne [83]. Increases of Glutathione levels may help reduce acne by reducing oxidative stress levels.

Treat Rheumatoid Arthritis

Antioxidant mechanisms can be unimpaired with Rheumatoid Arthritis. A Glutathione level is significantly lower in these patients [84]. Patients with rheumatoid arthritis have increased levels of Glutathione Peroxidase as a response to high levels of oxidative stress. It makes sense to supplement Glutathione to ensure that these individuals can match this high demand for Glutathione [85].

Prevent Glaucoma and Cataracts

Glaucoma and Cataracts can step by step caused loss of vision. Both conditions are in part caused by oxidative stress to the ocular nerve, which Glutathione may reduce [86].

Healthy Pregnancy

In pregnant women, low Glutathione levels caused by depression may lead to impaired brain development in the unborn child [87]. Increased amounts of reactive oxygen species in a fetus have been linked to preterm labor. Thus, by reducing these oxygen species, Glutathione can delay the onset of labor to a biologically healthier time [88].

Treat AIDS

A study showed that older AIDS patients produced lower levels of Glutathione in their mitochondria [89]. NAC (Glutathione's precursor) blocks the stimulatory effect of TNF on HIV copying [90]. Glutathione deficiencies can reduce insulin sensitivity and muscle strength in AIDS patient. Introducing adequate Glutathione treats these issues [90].

Glutathione deficiency fails the immune systems of AIDS patients with even now weak bodies. Studies have shown that giving these individuals additional Glutathione can rebalance their immune systems [91]. Introducing Glutathione into the body decreases the chances of AIDS sufferers developing tuberculosis [91].

Treat Cystic Fibrosis

People with cystic fibrosis have low Glutathione levels [92]. Cystic fibrosis affects the discharge of oxidative reactants into inflammatory cells. Making matters worse, cystic fibrosis reduces levels of Glutathione was able to scavenge these reactants [93]. Studies show that patients treated with inhaled Glutathione have increased lung capacity and function [94]. Glutathione inhalers can restore oxidant-antioxidant balance and reduce inflammation in those with cystic fibrosis [92]. More broadly, certain forms of buffered Glutathione have been found to lower the symptoms of cystic fibrosis [95].

Skin Lightening Agent

Studies have shown that Glutathione can increase the lightness of the skin in healthy women [96]. This is because Glutathione causes the production of different melanin in skin cells [96].

CONCLUSION

Glutathione is can prevent prevent damage to important cellular components caused by reactive oxygen species such as free radicals peroxides, lipid peroxides, and heavy metals. In the body, depend on GSH for the removal of toxins and function of other antioxidants. GSH can be purify a massive amount of a waste product by binding with a cancer-causing agent, heavy metals, herbicides, pesticides, and radiation by materializing a soluble compound with the toxin that can then be emitted through the urine or bile. In good physical shape, growth and activity of immune cells depend on the presences of GSH. The defensive action of GSH is as doubling; it improves the activity of immune cells, also functions as an antioxidant within them. Our energy levels depend on many features, the whole thing from the biochemical reactions taking place within our cells, to the function of muscle and even your sense of well-being. GSH facilitates the mitochondria of a cell to be effusively charged, improving muscle strength and stamina. Scientific legal proceedings have exposed that cell death by lowering GSH in the mitochondria. Our body frequently attacks from free radicals. Free radicals attack the nearest stable molecule, "stealing" it is an electron. A molecule which drops an electron develops a free radical itself and offensive the next nearest stable molecule, this begins a chain reaction. Once the reaction has started, it can fall through hundreds of molecules. As this happens regularly, the cell in time dies or alters. Sometimes the mutated cell mutates partly comes to know as cancer. GSH implements a dynamic role in renovating the damaged DNA by the missing electron. Usual to raised GSH hold on to the repair of our cells at a supreme and moderates the number of cell mutations that would occur otherwise.

Glutathione is at the heart of all immune functions and in many diseases such as neurological disorders, AIDS, progressive diabetes, and malignancies by a lack of GSH. Regulating GSH levels can aid to minimize the risk of diseases. In healthy cells and tissue, about 90% of the total glutathione in reduced form (GSH) and less than 10% exists in the oxidized form (GSSG). An increase of GSSG-to-GSH ratio will consider as an expressive of oxidative stress. The ratios used in scientifically as a measure of cellular toxicity. Therefore, suggests that Glutathione is important to a human healthy life and it can be recommended as a best therapeutic agent for incurable disease such cancer, diabetes, and neurological disorder, and skincare agent in cosmetic industries.

Competing interests

The author(s) declare that they have no competing interests.

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