

The Ultimate Guide to Glutathione

Author - Jackie Newson
BSc Hons, Nutritional Therapist

Editor - Susie DeBice
BSc Hons, Dip ION, Food Scientist and
Nutritional Therapist

With comments from cardiologist
Dr Thomas E Levy MD, JD

 **ABUNDANCE & HEALTH**
HIGH PERFORMANCE NUTRIENTS



Glutathione is often hailed as the master defender because of its key role in cell protection. It's produced primarily in the liver forming the enzyme glutathione peroxidase and is important for many aspects of cellular function. Let's look at how this indispensable nutrient works within the body...

Contents

| | |
|---|----|
| WHAT IS GLUTATHIONE? | 2 |
| THE MANY ROLES OF GLUTATHIONE | 3 |
| HOW MUCH GLUTATHIONE DO YOU NEED? | 9 |
| WHAT ARE THE BEST FOOD SOURCES OF GLUTATHIONE? | 10 |
| ARE THERE RISK FACTORS FOR A GLUTATHIONE DEFICIENCY? | 12 |
| SIX QUICK GLUTATHIONE FACTS... | 13 |
| ARE THERE DIFFERENT TYPES OF GLUTATHIONE SUPPLEMENTS? | 14 |
| WHAT EXACTLY ARE LIPOSOMES? | 15 |
| WHY ARE PHOSPHOLIPIDS SO IMPORTANT? | |
| WHY CHOOSE A LIPOSOMAL FORM OF GLUTATHIONE? | 16 |
| THE TOP 5 ADVANTAGES OF ALTRIENT GLUTATHIONE | |
| HOW SAFE IS GLUTATHIONE? | 17 |
| REFERENCES | 18 |

What is glutathione?

Glutathione is a water-soluble tripeptide, containing sulphur and three amino acids and serves as a reservoir for glutamate, cysteine and glycine. It exists in several different forms within the body, including an oxidized form (GSSG), a reduced form (GSH), a protein-bound form and a disulfide cysteine-containing form¹. The ratio of GSSH to GSH in the body helps provide an important indication of oxidative stress. Raised levels of GSSH suggest greater oxidative stress, whereas higher levels of GSH indicate protection against toxins and the damage caused by oxidative stress¹.

Glutathione is one of the most powerful intracellular (within the cell) defence nutrients found in almost every cell in the body and is highly active, particularly in cells that are most susceptible to toxicity such as the brain, kidneys, liver, heart, lungs, skin, intestinal epithelia, cornea and retina².



The many roles of glutathione

The fact that glutathione is present in the cells of all living organisms explains its important biological significance. Glutathione is primarily involved in the scavenging of reactive oxygen species (ROS), cellular detoxification and reduction of hydrogen peroxide. It also operates as an essential cofactor for various enzymes and plays a pivotal role in several important metabolic functions^{3,4,5} including:

- **Biochemical foundation of P450 enzyme detoxification in the liver, lungs, kidney and intestinal epithelia**
- **Participates in converting drugs and other toxic chemicals more water-soluble for easier excretion**
- **Participating in antioxidant defence systems**
- **Protection against free radicals**
- **Primary protectant of lens, cornea, skin and retina against radiation damage**
- **Regulating and maintaining cellular redox balance**
- **Helping metabolise oestrogens and inflammatory compounds**
- **Storing and transporting nitric oxide**
- **Storing cysteine reserves**
- **Regulating the function of proteins**
- **Involvement in DNA synthesis**
- **Participating in iron and copper transfer**

Glutathione tends to be found in high concentrations in all cells of the human body, particularly the liver. Medical interest in glutathione continues to increase as research demonstrates the protective and health-supporting properties of glutathione throughout the body. Glutathione depletion is linked to a variety of disease states⁶.

1. Why glutathione and vitamin C work so well together

On an intracellular level, glutathione is involved in complex molecular mechanisms that offers systemic protection against oxidative and free radical damage. Vitamin C has the capacity to perform the similar functions except vitamin C tends to work outside cells. Biologically, there is a fundamental synergy between vitamin C and glutathione as they help recharge and enhance each other. In fact, one of the most important functions of vitamin C is to help maintain normal glutathione levels inside the cell. Together they make a strong team tirelessly working to helping to support the health of body cells, tissues and organs.

2. How does glutathione support antioxidants?

Antioxidants help fight oxidation, which is caused when body cells utilise oxygen. When there are disruptions in the natural oxidation process, highly unstable and potentially damaging molecules called free radicals are created. Free radicals are atoms or groups of atoms that contain an odd number of electrons. Because electrons like to be in pairs, free radicals steal electrons from other molecules to maintain stability⁷. This process could cause damage to cells, proteins and DNA.

Antioxidants help protect cells from this type of damage or help to repair damage by supplying an infusion of electrons that help to neutralise free radicals.

Glutathione helps to recharge antioxidants with a steady flow of electrons and helps maintain the cell's antioxidant pool. Glutathione helps regenerate the antioxidant potential of superoxide dismutase (SOD), alpha-lipoic acid and vitamins C and E, protecting the cell from a chain reaction that may cause damage to the cell.

3. Why is glutathione ?

Glutathione is so important to the health of every cell in the body that cell death is likely when glutathione levels inside cells drop too low. Healthy unchallenged cells may produce a sufficient amount of glutathione for a host of protective and metabolic functions. Even without the extra toxic demands exerted by 21st century living, the requirement for glutathione production is remarkably high. However, normal energy production within the cell creates a host of pro-oxidant waste products, which glutathione helps neutralise. When there are additional pressures of emotional or physical stress, radiation, infection, an unhealthy diet, toxins, heavy metals, and the invasion of pathogens, cellular levels of glutathione could become quickly depleted, which may result in cellular damage.



4. What is the link between glutathione and immune function?

The immune system has an impressive, very complex defence system composed of antibodies, mast cells, macrophages and lymphocytes to thwart the attacks of ever-present toxins and pathogens. Mast cells and white blood cells are constantly patrolling the body and require a variety of protective compounds including glutathione, which is involved in the growth, proliferation and differentiation of white blood cells. Lymphocytes are the backbone of the active immune defence and studies show that glutathione is one of many important nutrients to support lymphocyte proliferation and differentiation into natural killer cells and T cells⁸.

5. Could glutathione help the memory?

Brain cells are more susceptible to oxidative stress than any other tissue in the body, particularly because of their high need for oxygen⁹. Some types of brain injury (stroke, traumatic injuries, heavy metal toxicity), brain disease (Parkinson's, Alzheimer's, MS), and brain disorders (schizophrenia, depression, sleep disorders), affect memory and cognitive function and may be accompanied by oxidative stress. Medical and basic science literature describes the importance of glutathione in many aspects of cellular function. Glutathione is an extremely important cellular protectant, which works alongside a host of other antioxidants to protect against cellular damage and support brain function.

6. What are the glutathione benefits for cardiovascular health?

The synergetic effects of glutathione and vitamin C are most visible in the coronary arteries. When nitric oxide activity is low in the cells lining the inside of the arteries, vascular spasm is more likely to occur, resulting in a constriction of these blood vessels. Research in patients with atherosclerosis has shown that glutathione and vitamin C supplementation supports nitric oxide activity and may have positive effects¹⁰.

7. Is glutathione good for lung health?

The lungs, where the exchange and presence of oxygen is continuous, are particularly vulnerable to reactive oxidative species (ROS), which at excessive levels could overwhelm the availability of antioxidants culminating in oxidative stress. In the lungs, a high concentration of glutathione is secreted by epithelial cells into a thin layer of fluid surrounding areas of gas exchange¹¹. This immediate source of glutathione is considered a first line defence against oxidative stress-induced damage¹².

8. Could glutathione be used to support eye health?

Virtually all diseases of the eye, particularly those associated with the progressive loss of vision, may intrinsically be linked with a loss of antioxidant stores and an increase of oxidative stress. Studies now show conclusively that cataracts, glaucoma, and macular degeneration are always accompanied by, and significantly worsened by, on-going and un-neutralised oxidative stress in the eye¹³. The synergistic actions of glutathione and vitamin C may therefore be a useful combination for eye health especially as vitamin C is shown to contribute to the protection of cells from oxidative stress.



9. How does glutathione work in the liver?

The liver is the largest reservoir of glutathione¹⁴. When the liver is healthy, it produces sufficient quantities of glutathione to perform its own important detoxification functions and also creates and dispenses a glutathione surplus into the bloodstream for numerous other metabolic requirements. Over time, exposure to a great variety and quantity of toxic chemicals encountered in everyday living may contribute to poor liver function. As the liver becomes compromised, it struggles to meet its own glutathione needs and there may be little surplus glutathione secreted into the blood for other organs of the body.

Dietary restrictions or an imbalance in your general health could influence the antioxidant status of the liver and your nutritional demands. Providing the correct balance of nutrients may sometimes be challenging, in these circumstances supplementing with a high quality rapidly absorbed glutathione supplement may offer valuable nutritional support.

10. Glutathione and excess alcohol intake

The liver has sophisticated mechanisms that help to neutralise the toxic effects of alcohol, which are very efficient provided you don't drink too much. After alcohol reaches the stomach it goes straight to the liver where with the help of a family of enzymes including glutathione peroxidase¹⁵, it is metabolised through two sequential steps. In the first stage the liver cells convert the alcohol into an inactive compound, and then in the second stage they are conjugated into a water-soluble compound that could be carried safely out of the body¹⁶. Glutathione is a major participant in phase 2 conjugation reactions¹⁷ and also helps neutralise oxidative stress brought about by alcohol consumption that may damage liver tissue. Glutathione therefore plays an important role in the detoxification of alcohol; however, it is quickly depleted when excessive levels of alcohol are consumed¹⁸.

How much glutathione do you need?

There are no government recommended levels for daily glutathione intake. Even though the body makes glutathione, it may often struggle to maintain healthy levels due to the continual onslaught of oxidative stress. As a result, many informed individuals seek to enhance their natural glutathione levels. However, it's only IV infusions of glutathione and oral liposomal glutathione that tend to be considered to deliver intact glutathione straight to the bloodstream. Results from a pilot study demonstrated that liposomal glutathione increased body stores of glutathione after oral administration and appeared to be effective at two doses (500 and 1000 mg/d). These beneficial effects were seen from as early as week one¹⁹.



What are the best food sources of glutathione?

Glutathione is found naturally in many vegetables, fruits and meats, however absorption rates from food sources in the human digestive tract tend to be low²⁰. Amounts available from foods are limited, usually less than 150mg per day²¹.

Natural sources of glutathione include:

| FRUIT | VEGETABLES |
|------------|-------------------------|
| AVOCADO | ASPARAGUS |
| BANANA | BROCCOLI |
| GRAPEFRUIT | CARROT |
| LEMON | CAULIFLOWER |
| MANGO | CUCUMBER |
| ORANGE | GREEN BEANS |
| PAPAYA | GREEN AND RED PEPPER |
| STRAWBERRY | GREEN AND YELLOW SQUASH |
| TOMATO | MUSHROOMS |
| | PARSLEY |
| | POTATO |
| | SPINACH |

* Source: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6770193/#B151-nutrients-11-02073> ¹⁶



Are there risk factors for a glutathione deficiency?

Glutathione deficiency is thought to interfere with a cell's ability to clear cellular waste, and to impair defense against ROS, reactive nitrogen species and hydrogen peroxide. Some individuals with inherited deficiencies of specific enzymes that synthesise glutathione may develop neurological complications later in life²².

A number of other factors may deplete glutathione levels including:

- **UV radiation**
- **Viral infections such as hepatitis**
- **Household chemicals**
- **Heavy metals**
- **Environmental toxins**
- **Surgery**
- **Inflammation**
- **Septic shock**
- **Burns**
- **Dietary deficiencies of enzyme cofactors or glutathione precursors**
- **Liver cirrhosis**
- **Acute or chronic alcohol intake**
- **Some pharmaceutical drugs**
- **Some pulmonary diseases**

Six quick glutathione facts...

1. Regular exercise increases glutathione levels²³.
2. Both Alpha-lipoic acid and vitamin C taken daily raise red blood cell levels of glutathione.
3. Glutathione antioxidant defences of the body decrease after the age of forty-five²⁴.
4. The widely cultivated Agaricus Bisporus mushroom is shown to have high levels of glutathione²⁵.
5. Glutathione has the ability to regenerate other antioxidants, including vitamins C and E.
6. Sulphur rich foods like meat, poultry and fish contain the amino acids needed for the body to produce glutathione.

Are there different types of glutathione supplements?

There are numerous delivery forms for glutathione including intravenous, nasal spray, liposomal, transdermal and oral dosage forms including tablets, capsules, powders, and sprays.

Glutathione is available in the following preparations:

- **L-Glutathione or reduced glutathione** – is the most commonly found supplemental form. To be an effective free radical scavenger glutathione needs to be in a reduced state.
- **Liposomal glutathione** – traditionally glutathione is not thought to be systemically bioavailable when taken orally due to its enzymatic breakdown in the intestine. The advantage of liposomal glutathione is that the nutrient is encapsulated within a phospholipid barrier similar to a natural cell membrane that offers protection from gastrointestinal juices and transports it rapidly to the cells that need it. The use of liposomes has already been seen as an effective means of drug delivery, allowing for greater bioavailability and delivery of both fat-soluble and water-soluble substances.
- **Acetyl Glutathione** – adding an acetyl function group makes the GSH molecule more stable and is thought to enhance delivery through the circulation and to the brain.
- **Other nutrients** – Alpha-lipoic acid, N-acetyl cysteine, selenium and SAME are also useful as they help support the body to generate glutathione.



What exactly are liposomes?

Liposomes are used as carriers for a range of nutrients. They are small artificial fluid filled sacs, spherical in shape that are created from natural non-toxic phospholipids to encapsulate and transport nutrients²⁶. These clever microscopic bubbles consist of a liquid core surrounded by one or more phospholipid layers, the same material found in human cell membranes.

The bilayer membrane structure of liposomes guarantees that both water-soluble compounds and fat-soluble compounds can be efficiently and simultaneously entrapped within it. Water-soluble nutrients such as glutathione can be encapsulated in the liquid center, while fat-soluble compounds can be incorporated into the lipid bilayer²⁷.

The entrapment of a nutrient within a phospholipid substance substantially improves its bioavailability and adds a layer of protection against its reactive surroundings slowing down degenerative processes²⁸. What's more, the phospholipids themselves are therapeutically useful nutrients with many health benefits. Studies show that liposomes increase the stability and bioavailability of the enclosed nutrients enhancing intracellular uptake²⁹.

Why are phospholipids so important?

The fundamental building blocks of all cell membranes are phospholipids, which arrange themselves into two parallel layers called a bilayer. The phospholipids provide barriers to protect the cell as well as creating pathways for substances to cross the membrane into the cell. Both are critical to the cell's ability to function. Phospholipids regulate cellular processes related to growth, nerve transmission and immune surveillance. They also work as emulsifiers and help to transport triglycerides and cholesterol in the blood³⁰.

One of the main classes of phospholipids is phosphatidylcholine, which is an important source of the omega 3 essential fatty acids EPA and DHA. These substances are known to play a positive role in several functions in the body. Studies show that DHA contributes to the maintenance of normal brain function and normal vision and both EPA and DHA contribute to the normal function of the heart.

Why choose a liposomal form of glutathione?

Sometimes, something too good to be true, really is true. This is certainly the case with high quality liposomes and properly dosed nutrients. Recent research suggests that when glutathione is delivered in a liposomal form it enhances uptake and favourably impacts systemic glutathione levels³¹. This explains why liposome encapsulated glutathione is proving to be the most elite and spectacularly successful of nutrient supplementation available. The dawn of a new healing therapy has arrived! A good quality source of liposomal glutathione is manufactured by LivOn Labs with the Altrient trademark.

The top 5 advantages of Altrient Glutathione

1. **Survives digestion** – Altrient Glutathione GSH is protected by a double walled cell membrane while it journeys through the stomach allowing it to be absorbed intact into the blood stream.
2. **Superior absorption** – Standard oral glutathione products are poorly absorbed due to the action of an intestinal enzyme that degrades glutathione. Altrient's Liposomal GSH uses cutting edge technology, to deliver maximised absorption that is proven to exceed standard glutathione absorption rates.
3. **Supports antioxidant activity** – Altrient Glutathione GSH helps to regenerate important antioxidant nutrients and is the perfect complement to a well-balanced antioxidant rich diet.
4. **Convenient** – Altrient Glutathione provides high quality nutritional support in handy single dose sachets, for people with busy, active lives.
5. **Supports the liver** – Glutathione is an important co-factor for a number of detoxifying enzymes and is most concentrated in the liver. Altrient GSH is the number one choice for people wishing to support liver health.

How safe is GSH?

Glutathione is thought to be safe when taken orally, by intravenous injection and when inhaled. There is no known information regarding side effects. Due to a lack of reliable research it is not safe to take GSH during pregnancy and breastfeeding. Asthma sufferers should not take GSH as it may exacerbate some asthma symptoms.

Please note - This article was created by Jacqueline Newson BSc (Hons) Nutritional Therapy and edited by Food Scientist Susie Debrace using extracts from the booklet GSH Master Defender by Dr Levy MD.



References

1. Natural Medicine Journal. Glutathione. https://www.naturalmedicinejournal.com/sites/default/files/glutathione_final_digital.pdf. [Accessed 16.4.20].
2. Foundational Medicine. Monograph, Glutathione. <http://archive.foundationalmedicinereview.com/publications/6/6/601.pdf>. [Accessed 17.4.20].
3. Garcia-Gimenez JL & Pallardo FV. Maintenance of glutathione levels and its importance in epigenetic regulation. *Front. Pharmacol.* 2014; 5,88.
4. Minich DM, Brown BI. A Review of Dietary (Phyto)Nutrients for Glutathione Support. *Nutrients.* 2019;11(9):2073.
5. Roum JH, Buhl R, McElvaney NG, Borok Z, Crystal RG. Systemic deficiency of glutathione in cystic fibrosis. *J Appl Physiol* 1993;75(6):2419–24.
6. Roum JH, Buhl R, McElvaney NG, Borok Z, Crystal RG. Systemic deficiency of glutathione in cystic fibrosis. *J Appl Physiol* 1993;75(6):2419–24.
7. Szalay J. Live Science. What are Free Radicals? <https://www.livescience.com/54901-free-radicals.html> [Accessed 20.4.20.]
8. Hamilos DL, Mascali JJ & Zelarny P. Lymphocyte proliferation in glutathione-depleted lymphocytes: direct relationship between glutathione availability and the proliferative response. *Immunopharmacology* 1989, 18,3: 223-235.
9. Bailey DM, Cobley JN, Fiorello ML. 13 reasons why the brain is susceptible to oxidative stress. *Redox Biology* 2018; 15: 490-503.
10. Andrews NP et al. Glutathione reverses endothelial dysfunction and improves nitric oxide bioavailability. *Journal of the American College of Cardiology* 1999; 34,2: 507-514.
11. Pizzorno, Joseph E.; Katzinger, Joseph J. Glutathione: Physiological and Clinical Relevance. *Journal of Restorative Medicine*, 2012; 1,1: 24-37.
12. Kelly FJ. Glutathione: in defence of the lung. *Food Chem Toxicol* 1999; 37(9–10):963–6.
13. Kruk J, Kubasik-Kladna K, Aboul-Enein HY. The Role Oxidative Stress in the Pathogenesis of Eye Diseases: Current Status and a Dual Role of Physical Activity. *Mini Rev Med Chem.* 2015;16(3):241-57.
14. Minich DM, Brown BI. A Review of Dietary (Phyto)Nutrients for Glutathione Support. *Nutrients.* 2019;11(9):2073.
15. Moossavi S, Besharat S, Sharafkhah M, et al. Inverse Association of Plasma Level of Glutathione Peroxidase with Liver Fibrosis in Chronic Hepatitis B: Potential Role of Iron. *Middle East J Dig Dis.* 2016;8(2):122–130.
16. Duke University. The Alcohol Pharmacology Education Partnership. <https://sites.duke.edu/apep/module-1-gender-matters/content/content-how-is-alcohol-eliminated-from-the-body/> [Accessed 17.4.20].
17. Allameh A & ziglar T. The significance of glutathione conjugation in aflatoxin metabolism. <https://www.intechopen.com/books/aflatoxins-recent-advances-and-future-prospects/the-significance-of-glutathione-conjugation-in-aflatoxin-metabolism> [Accessed 16.4.20]
18. Moossavi S, Besharat S, Sharafkhah M, et al. Inverse Association of Plasma Level of Glutathione Peroxidase with Liver Fibrosis in Chronic Hepatitis B: Potential Role of Iron. *Middle East J Dig Dis.* 2016;8(2):122–130.
19. Calcagnotto A et al. Oral supplementation with liposomal glutathione elevates body stores of glutathione and markers of immune function. *Eur J Clin Nutr.* 2018; 72(1): 105–111.
20. Zhang H., Forman H.J., Choi J. Gamma-glutamyl transpeptidase in glutathione biosynthesis. *Methods Enzymol.* 2005;401:468–483.
21. Foundational Medicine. Monograph, Glutathione. <http://archive.foundationalmedicinereview.com/publications/6/6/601.pdf>. [Accessed 17.4.20].
22. Minich DM, Brown BI. A Review of Dietary (Phyto)Nutrients for Glutathione Support. *Nutrients.* 2019;11(9):2073.
23. Kerksick, C., Willoughby, D. The Antioxidant Role of Glutathione and N-Acetyl-Cysteine Supplements and Exercise-Induced Oxidative Stress. *J Int Soc Sports Nutr.* 2005; 2, 38.
24. <https://www.mdpi.com/2076-3921/7/5/62/htm> . [Accessed 19.4.20].
25. Mohamed, Eman Mostafa. (2012). Chemical profile, agaritine and selenium content of *Agaricus bisporus*. *Brazilian Archives of Biology and Technology*, 55(6), 911-920.
26. Akbarzadeh A et al. Liposome: classification, preparation, and applications. *Nanoscale Research Letters* 2013; 8:102
27. Suntres Z E. Liposomal Antioxidants for Protection against Oxidant-Induced Damage. *Journal of Toxicology* 2011,152474: 1-16.
28. Saraf AS. Applications of novel drug delivery system for herbal formulations. *Fitoterapia* 2010; 81: 680–689.
29. Akbarzadeh A et al. Liposome: classification, preparation, and applications. *Nanoscale Research Letters* 2013; 8:102
30. Dotson D. What are the primary functions of phospholipids? <https://sciencing.com/primary-functions-phospholipids-7349125.html>. [Accessed 20.4.20].
31. Minich DM, Brown BI. A Review of Dietary (Phyto)Nutrients for Glutathione Support. *Nutrients.* 2019;11(9):2073.
32. Ballatori N, Hammond CL, Lee TK. Novel roles for glutathione in gene expression, cell death, and membrane transport of organic solutes. *Journal of Hepatology* 34 (2001) 946-954.
33. Dotson D. What are the primary functions of phospholipids? <https://sciencing.com/primary-functions-phospholipids-7349125.html>. [Accessed 20.4.20].
34. Vogt BL, Richie JP Jr. Glutathione depletion and recovery after acute ethanol administration in the aging mouse. *Biochem Pharmacol.* 2007;73(10):1613–1621.



The Ultimate Guide to Glutathione

IE: +353 (0)1 254 8889
UK: +44 (0) 20 3239 4907
info@abundanceandhealth.com

www.abundanceandhealth.co.uk