WHO NEEDS GLUTATHIONE?

Risk Factors in Glutathione Depletion

Glutathione, a nutrient-like substance that is made in the body as well as consumed through the diet, is one of the most important protective molecules in human biology. As a powerful antioxidant it neutralizes harmful free radicals and recycles vitamins E and C, the other two main dietary antioxidants. As an anticarcinogen it binds with and eliminates cancer-causing chemicals. In these roles it acts as a molecular "garbage collector," cruising all tissues and removing unwanted toxins.

Another important role of glutathione is to provide the body with amino acids for the vital protein functions of cells. In this role too it can affect every cell and tissue in the body. Interestingly, the breakdown of glutathione into its three amino acids is a reversible process; the entire glutathione pool throughout the body turns over daily as it is both broken down and synthesized. Large stores of glutathione are not maintained, so it must be replenished daily.

How much glutathione is needed?

An official recommended intake has not been set for glutathione because diet is not the sole source, and therefore, glutathione cannot be classified as an essential nutrient. Scientists have measured the amount of glutathione provided by foods and found that the best sources are fresh fruits and vegetables and freshly prepared meats. Diets that are high in these foods provide approximately 150 milligrams of glutathione per day, whereas poor diets may provide as little as 3 milligrams daily of glutathione.

In general, scientific evidence suggests that a healthy intake should be in the range of 100 to 150 milligrams per day. However, the average intake in the U.S. is only about 35 milligrams per day, leaving a considerable gap.

Considering the variety of factors that can deplete glutathione, a sizable proportion of the population could conceivably benefit from increasing its glutathione intake, either by eating more fresh foods or by supplementing their diet.

Risk factor: morning

Researchers have recently discovered that the glutathione cycle follows a diurnal pattern, with lowest levels occurring in the morning. Levels increase in a spiked pattern about six hours after each meal and peak between 2:00 and 3:30 in the morning, followed by a steep decline.[1]

This cycle results in a relative deficiency of glutathione in the morning hours that may extend into the afternoon. In people over age 60, there is a more pronounced difference between the glutathione peaks and valleys, which could be important given that the glutathione "valleys" are periods of vulnerability for oxidative stress and age-related chronic conditions.

Risk factor: age

Glutathione status generally begins to weaken around age 45 and declines precipitously after age 60.[2] The aging body is not able to make as much glutathione due to decreased enzyme activity and lower efficiency of the cellular signals that trigger glutathione synthesis.

This loss in glutathione protection may leave one more vulnerable to oxidative processes that underlie chronic diseases of aging such as heart disease, cancer and age-related eye disease. Scientific research has correlated reduced glutathione status and/or dietary intakes with early markers of cardiovascular disease;[3] higher risk of oral and pharyngeal cancer,[4,5] and age-related macular degeneration.[6,7]

In one study, higher glutathione status in older individuals was correlated with good health as assessed by multiple measures: fewer number of illnesses, higher levels of self-rated health, lower cholesterol, lower body mass index and lower blood pressures. In contrast, those with poorer health as well as those diagnosed with arthritis, diabetes or heart disease had lower glutathione levels.[8]

Another study of 87 healthy women aged 60 to 103 years found that high blood glutathione concentrations were characteristic of long-lived women who were in excellent physical and mental health.[9]

Risk factor: diet

Since fresh foods are truly the only good sources of glutathione, a Mediterranean-style diet that is plentiful in fresh fruits and vegetables and freshly prepared meats is best for maintaining good glutathione status. However, many diets today rely heavily on processed foods. These do not provide glutathione since most methods of food processing destroy it. Likewise, grain and dairy products are not good sources. Therefore, many diets commonly consumed in the U.S. provide inadequate glutathione to support optimal health.

Risk factors: lifestyle habits

Lifestyle habits such as cigarette smoking and excessive consumption of alcohol are detrimental to glutathione status because they dramatically increase the demand for protection. High levels of glutathione are normally maintained in the fluid lining of the lungs (alveolar fluid) in order to detoxify and neutralize harmful inhaled compounds. Glutathione is extensively oxidized in smokers as compared to nonsmokers.[10]

Alcohol independently makes the lungs more susceptible to oxidative injury, and the damage is compounded in people who both smoke and drink. Acute respiratory distress syndrome has been linked in the past with a history of alcohol abuse. Recent studies suggest this may be due to depletion of the glutathione levels within the alveolar space by alcohol by as much as 80 to 90 percent.[11] In those who not only drink excessively but also smoke, glutathione defenses are completely overwhelmed.[12]

Risk factor: obesity

Obesity is correlated with oxidative stress stemming from metabolic processes that create a low-level inflammation in white adipose tissue (fat stores). This chronic oxidative stress is believed to be a major contributing factor to the development of insulin resistance, impaired glucose tolerance and diabetes. Antioxidant defenses including glutathione are depleted in obese persons.[13,14,15]

Risk factor: diabetes

The hyperglycemia that characterizes diabetes causes metabolic changes that speed the production of damaging free radicals, and oxidative stress is believed to play an important role in the development of diabetes complications such as kidney damage, nerve damage and blindness. Glutathione levels are low in people with diabetes as compared to non-diabetic controls.[16] In an animal model of diabetes, dietary glutathione can suppress oxidative stress, particularly in the lens of the eye.[17]

Other risk factors

Any condition that increases the oxidative load on the body is by definition one that uses more glutathione, potentially increasing requirements beyond what is furnished in the diet or what the body is able to produce. Oxidative stress is linked to a host of diseases and disorders that are common today, including cardiovascular disease and stroke, cancer, neurodegenerative diseases such as Parkinson's and Alzheimer's, diabetes, cataracts, macular degeneration, HIV, hepatitis B, asthma, chronic obstructive pulmonary disease and other lung diseases, and inflammatory disorders. In fact, oxidative stress has been linked to more than 250 diseases, all of which translate to increased challenges for glutathione and other components of the body's antioxidant defense system.

Beyond tobacco and alcohol, there are other sources of oxidants in our environment such as ultraviolet radiation, ionizing radiation, oil fumes, saturated fats, pollutants and chemicals. There is no reliable way to calculate cumulative exposure to reactive oxidants or to establish a precise requirement for glutathione for all people. However, it is possible to calculate the number of people with known exposures, giving an idea of the magnitude of the "glutathione gap" in the U.S. today.

The following chart provides estimates of the number of Americans who have known risk factors for glutathione depletion and could potentially benefit from increasing their glutathione intake.

The "glutathione gap:" Americans with risk factors for glutathione depletion

Risk Factor	% of Population	# of Americans (in millions)

Over age 45	50	140
• 55-64	14	41
• 65+	17	50
Consume <5 F/V daily	75	222
Current smokers	20	59
Heavy drinkers	5	15
Overweight	37	110
Obese	26	77
Diabetes	25	74

Source: Centers for Disease Control, Behavioral Risk Factor Surveillance System; Prevalence and Trends Data

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