

## GOOD MORNING, GLUTATHIONE!

Here's a surprise: If you eat a breakfast of a whole orange, steak and eggs, you are on your way to a healthy day by helping your body replenish its glutathione reserve; but if you have cereal with blueberries and 2% milk and a glass of apple juice for breakfast, you may be sabotaging your antioxidant protection. This seems to contradict what mainstream nutrition teaches about a healthy diet, but it's true for glutathione because the ways of optimizing one's status of this valuable antioxidant do not always conform to common maxims.

Many foods that are good for us – such as whole wheat bread, cereal grains, milk and yogurt – provide little or no glutathione, nor are they good sources of its precursor amino acids (cysteine, glutamate, glycine). Other foods contain reactive compounds that are antagonistic to glutathione and can destroy it before it ever leaves the spoon! Thus, compiling a glutathione-friendly diet can be a brain-tickling exercise even for professional nutritionists.

The best dietary sources of glutathione are fresh fruits and vegetables and freshly prepared meats. Some of these include:

<b>Fruits</b>	<b>Vegetables</b>	<b>Meats</b>
Apples	Acorn squash	Beef (grilled, roasted)
Bananas	Asparagus	Chicken (baked, fried)
Oranges	Avocado	Fish
Strawberries	Broccoli	Ham (boiled)
Tomatoes (raw)	Carrots (raw)	Hamburger (pan fried)
Watermelon	Potatoes	Pork
	Spinach	Steak (grilled, pan fried)

In addition, cruciferous vegetables (broccoli, cauliflower, Brussels sprouts, cabbage, kale), allyl-containing vegetables (garlic, onion, leeks, chives), and polyphenol-containing fruits and vegetables such as \_\_\_\_\_ contain compounds that activate protective glutathione enzymes and boost internal production of glutathione. These foods are called *phase 2 enzyme inducers* and may be thought of as glutathione promoters.

The key to obtaining the benefits of these foods is freshness. Most food processing methods other than freezing destroy glutathione, and therefore canned fruits and vegetables, fruit juices and drinks, and cured and processed meats do not contribute glutathione to the diet.

A study that tested the amounts of glutathione versus glutathione antagonists in 142 foods found that among the food groups, cereals, bread, milk and milk products (cottage cheese, American cheese) have relatively high levels of antagonists and low levels of glutathione.<sup>1</sup> Common beverages such as coffee and tea also contained glutathione-destroying compounds, although in lower concentrations.

The most surprising finding was that three fruits known to be antioxidant powerhouses themselves – blueberries, cherries and prunes – were high in glutathione antagonists. Therefore, whatever antioxidant activity they confer is due to compounds other than glutathione, and in fact, they may impair the body's glutathione status, thereby cancelling out some of their potential antioxidant benefits.

Adding to the complexity is the finding that plasma glutathione status undulates over a 24-hour period, according to researchers at Emory University.<sup>2</sup> The lowest levels of glutathione are found in the morning hours through midday. 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.

This diurnal variation 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.

Glutathione status generally begins to decline between the ages of 45 and 50 and declines very rapidly at advanced age. The body's ability to synthesize glutathione declines due to decreased enzyme activity and a loss in the efficiency of cellular signals that trigger glutathione synthesis. It is probably no coincidence that this is also the time

of life when risk of diseases linked to oxidative stress, such as cardiovascular disease, age-related eye diseases and cancers, begins to rise.

While cause-and-effect has yet to be shown, biochemical evidence suggests that maintaining adequate glutathione status may attenuate some of the events that lead to age-related conditions. For example:

- The balance between glutathione and its oxidized form in plasma was found to be an accurate predictor of the earliest stages of atherosclerosis (buildup of plaque in the arteries), which is the beginning of cardiovascular disease.<sup>3</sup>
- Proliferation of colon cancer cells *in vitro* is doubled when glutathione is oxidized.<sup>4</sup>
- A decrease in enzymes involved in the synthesis of glutathione has been associated with age-related macular degeneration (AMD),<sup>5</sup> and low plasma levels of glutathione have been correlated with the presence of serious AMD.<sup>6</sup>

In summary, the central protective system provided by glutathione is directly linked to healthy tissue and organ functions, and its maintenance throughout life is important in maintaining good health. The morning hours, especially for people over age 50, represent a window of vulnerability that can be improved by increased intake of glutathione-containing foods and/or glutathione supplements at breakfast. Glutathione is one more reason to believe that “breakfast is the most important meal of the day.”

#####

## References

---

<sup>1</sup> He M *et al.* Total equivalent of reactive chemicals in 142 human food items is highly variable within and between major food groups. *J Nutr.* 2004 May;134(5):1114-19.

---

<sup>2</sup> Blanco RA *et al.* Diurnal variation in glutathione and cysteine redox states in human plasma. *Am J Clin Nutr.* 2007 Oct;86(4):1016-23.

<sup>3</sup> Ashfaq S *et al.* The relationship between plasma levels of oxidized and reduced thiols and early atherosclerosis in healthy adults. *J Am Coll Cardiol.* 2006 Mar 7;47(5):1005-11.

<sup>4</sup> Jonas CR *et al.* Extracellular thiol/disulfide redox state affects proliferation rate in a human colon carcinoma (Caco2) cell line. *Free Radic Biol Med.* 2002;33:1499-506.

<sup>5</sup> Cohen SM *et al.* Low glutathione reductase and peroxidase activity in age-related macular degeneration. *Br J Ophthalmol.* 1994 Oct;78(10):791-94.

<sup>6</sup> Coral K *et al.* Plasma homocysteine and total thiol content in patients with exudative age-related macular degeneration. *Eye.* 2006 Feb;20(2):203-7.