

Liver Detox Pathways and Vitamins and Foods that Support These Pathways

This comes from Dr. Datis Kharrazian, in his course, Functional Blood Chemistry Analysis.

Glutathione Conjugation

[Glutathione](#) is an amino acid consisting of glycine, cysteine and glutamic acid and is also known as (the impossible to pronounce) gamma-glutamylcysteinylglycine. In addition to playing an important role in phase II conjugation, glutathione is also primary cellular agent of cells and is involved in "reducing" which basically means donating electrons. It helps to maintain the structure of red blood cells and other cellular proteins. It also is responsible for the creation of hormones involved in inflammation and allergic reactions and it functions as a carrier of sulfur containing amino acids (amino acids that are important in fat metabolism) in the cells. As a phase II detoxifier, glutathione binds with phase I compounds to produce water soluble materials that are excreted from the body via the urine. It is available via 2 routes: diet and synthesis.

Dietary Sources of Glutathione

Many foods contain glutathione including fresh vegetables, fresh fruits, fish and meats. On the other hand, there are many different disorders that can cause glutathione conjugation problems including: lack of nutrients used to synthesize it, problems with enzymes that help produce it and smoking, which depletes it.

Glutathione levels are also depleted by conditions that place the body under stress, such as: infections, cancer, gastrointestinal or respiratory inflammation, etc. Magnesium and potassium are important electrolytes used in glutathione production. Conditions that deplete these important minerals can also be problematic. For example, adrenal overactivity can deplete potassium. The synthesis of the 3 amino acids that combine to make glutathione is dependent on vitamin B6, folic acid, choline, riboflavin, methionine, cysteine, n-acetylcysteine, vitamin C, betaine, glycine, glutamic acid, potassium, copper, zinc and selenium.

Acetylation

Acetylation pathways bind toxins with acetyl-CoA (the major fuel for the oxidative processes in the body, made from the breakdown of glucose and fatty acids.) **These pathways are dependent on pantothenic acid, thiamin, and vitamin C.**

Methylation

Methylation involves binding methyl groups with phase I end products. Methyl groups are a group of molecules that have a strong influence on bioactivity, adding a methyl group can make DNA inactive. For example, methylation is able to inactivate estrogens, supporting the use of methionine in conditions of estrogen excess, such as PMS. **Proper methylation requires methionine, betaine, Vitamin C, Vitamin E, choline, magnesium, methylcobalamin (Vitamin B12), folic acid, and Vitamin B6.**

Sulfation

Smells like rotten eggs

Sulfation involves binding phase I end products with sulfur containing compounds. It is one of the major detoxification pathways for neurotransmitters, toxins, steroids and protein based hormones. Vitamin B6 and magnesium are important for sulfur amino acid metabolism, as are foods containing sulfur such as: eggs, cheese, meat, poultry, nuts and legumes.

Its important to choose animals products wisely, buy organic because organic foods have far fewer toxins like antibiotics, hormones, and pesticides which you are trying to get rid of in this process. Another important point regarding phase II sulfation is that this requires sulfate which is often poorly absorbed by the digestive system. Sulfate is the oxidized, inorganic form of sulfur produced by an oxidation step called (you guessed it) sulfoxidation. This step is made possible by an enzyme that is called sulfite oxidase which uses the essential mineral molybdenum. **Problems with sulfoxidation can be seen in people who are sensitive to foods that contain sulfites (garlic) or dugs and food additives (in dried fruit and herbs, preservatives, in salad bars used to keep vegetables looking fresh).**

These people may also have an abnormally strong odor in their urine after eating asparagus. For these people one should consider

molybdenum supplementation or organic sulfates like sodium sulfate or magnesium sulfate.

Glucoronidation

Glucoronidation is the binding of toxins with glucuronic acid and it requires the enzyme UDPGT.

This pathway is supported by B vitamins, magnesium, and glycine, which help support the uronic acid pathway that synthesizes glucuronic acid.