

# **Liver Detoxification**

## **How It Works**

The human liver is responsible for an enormous number of biologic activities; it is the primary organ responsible for the detoxification of harmful substances. To successfully eliminate the wide variety of substances we are exposed to each day, the liver first filters the bloodstream to remove large toxins, including bacteria, endotoxins, and antigen-antibody complexes, and then utilizes enzyme pathways to detoxify smaller compounds.' Liver detoxification occurs in two phases: During Phase I, enzymatic chemical reactions change both exogenous substances (e.g., prescription medications and pesticides) and endogenous toxins (e.g., hormones) into more water-soluble metabolites. In Phase II detoxification, the liver conjugates these metabolites to protective compounds- such as glucuronides, glutathione, sulfonates and amino acids- that make them less harmful and easier to eliminate?

During hydroxylation and other Phase I chemical reactions, free radicals (highly active and unstable molecules) are produced. While free radical formation is both normal and necessary, exposure to excessive amounts of toxins can induce Phase I enzymes to create large amounts of free radicals. Unless this process is stopped or slowed by available antioxidants, chain reactions of free radical formation will result. Glutathione is the most important intracellular antioxidant. It plays a critical role in both Phase I and Phase II detoxification. When the liver is exposed to high levels of saturated fats, exhaust fumes, pesticides, paints, or other known inducers of Phase I detoxification enzymes, the resulting free radicals tend to deplete glutathione. This in turn, impedes Phase II detoxification and can thus increase the cumulative toxic burden on the liver. Antioxidants are a category of nutrients that work in a variety of ways to reduce free radical damage, including the direct quenching of free radicals, the regeneration of other antioxidants, and the protection of cell membranes. For the liver's detoxification activities to function effectively, a continuous supply of specific vitamins, minerals, plant compounds, enzymes, amino acids and other nutrients is necessary.

The following table provides information on the antioxidants in Detoxification Factors:

<b>Phase I Nutritional Support</b>	
<b>Antioxidants</b>	<b>Detoxification Activities</b>
<b>Reduced glutathione (GSH)</b>	The most versatile and powerful of all antioxidants. The highest concentration is found in the liver, where it plays a central role in detoxification. Also found in white blood cells, GSH fights the free radicals that these immune cells naturally generate. Prevents free radical chain reactions and is vital in the regeneration of other antioxidants, such as vitamin C and E. Levels of GSH naturally decline with age and during times of intense oxidation and free radical formation.

N-Acetyl-L-Cysteine (NAC)	Precursor to GSH, NAC promotes healthy detoxification and elimination of intestinal endotoxins. It is a standard-of-care for managing toxic exposures.
Coenzyme Q10(CoQ10)	Shown to protect cholesterol against oxidative damage, a property that makes it vitally important for heart health." Also protects the gums and periodontal tissues from free radical damage, supporting the oral cavity's detoxification activities.
Vitamin C	Plays an important role in the liver's detoxification activities, particularly hydroxylation reactions in Phase I. Also involved in the metabolism and excretion of mercury and other heavy metals.
Vitamin E	As an antioxidant it is well known for its ability to protect lipoproteins from oxidation and cell membranes from damage by quenching free radicals.
Selenium	Antioxidant needed for Phase I detoxification; especially useful in supporting the elimination of heavy metals, such as mercury and arsenic. Also a cofactor for glutathione production. Supports cellular function, helping them regain healthy cell cycling activity.
Quercetin	A bioflavonoid that effectively protects cells and tissues against oxidation, scavenges free radicals, and supports healthy cell development; it is also recognized for the unique way it enhances liver enzymes in the detoxification process.
Milk Thistle (Silybum marianum)	Silymarin is the main active compound in milk thistle. Milk thistle's effectiveness in supporting the liver's detoxification processes is due in part to the liver's unique recirculation of silymarin. This results in higher concentrations of silymarin in liver cells than in the bloodstream. Silymarin has a direct effect on the membrane of liver cells, keeping harmful substances out and allowing beneficial nutrients to enter. It also stimulates healthy liver cell development.

Phase II detoxification processes includes glucuronidation, sulfonation, methylation, and amino acid conjugation, for the protection of vital cellular components. The following table provides information on the Phase II supportive ingredients found in Detoxification Factors.

### Phase II Nutritional Support

Calcium D-glucarate	A precursor of glucarolactone (GL), which inhibits the enzyme, glucuronidase. Supplementation increases the net elimination of toxins and steroid hormones via glucuronidation; also shown to support healthy cellular proliferation.
Reduced glutathione (GSH)	Adequate amounts of GSH result in increased elimination of toxins and steroid hormones via glucuronidation.* Glutathione is capable of directly conjugating toxins in the liver, facilitating elimination. An important intracellular antioxidant, for supporting healthy cell structures.
N-Acetyl-L-Cysteine (NAC)	Sulfonation is another important conjugation reaction, and represents an effective means to decrease the activity of toxic agents. In addition to detoxifying substances, sulfonation is important in the metabolism of endogenous compounds, such as catecholamine, some steroids, and bile acids. <sup>33</sup> By supporting Phase II sulfation and GSH metabolism, NAC supports cellular health and aids in excretion of toxins.
Vitamin B6	Also needed for critical sulfonation reactions, vitamin B6 acts a cofactor in the sulfonation of homocysteine to nontoxic cysteine.
Vitamin B12 Folic acid	Methylation is a common conjugation reaction. Methyl groups are added to many exogenous and endogenous compounds to reduce their toxicity. Vitamin B12 and folic acid are required as nutritional cofactors for methylation reactions.
Glycine Taurine Glutamine	Amino acid conjugation primarily utilizes glycine, glutamine, and taurine. Glutamine, a conditionally essential amino acid, is involved in the detoxification of ammonia; taurine is needed for bile acid conjugation.
Ornithine aspartate	Supports healthy ammonia levels, healthy mental status, and healthy clinical parameters especially with regard to liver health and function.

### **Conclusion**

Formulated to support hepatic detoxification, Detoxification Factors offers comprehensive nutritional support for Phase I and II detoxification pathways. This physician-formulated, time-tested formula provides the select amino acids, antioxidants, vitamins, minerals and trace elements shown in research to support healthy detoxification. Feel free to contact us for more information.

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