

Supports for Liver Detoxification

Naturopathic Perspectives



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The body's ability to detoxify uses several organs such as kidneys, the liver, the skin, bowels, and the lymphatic system.

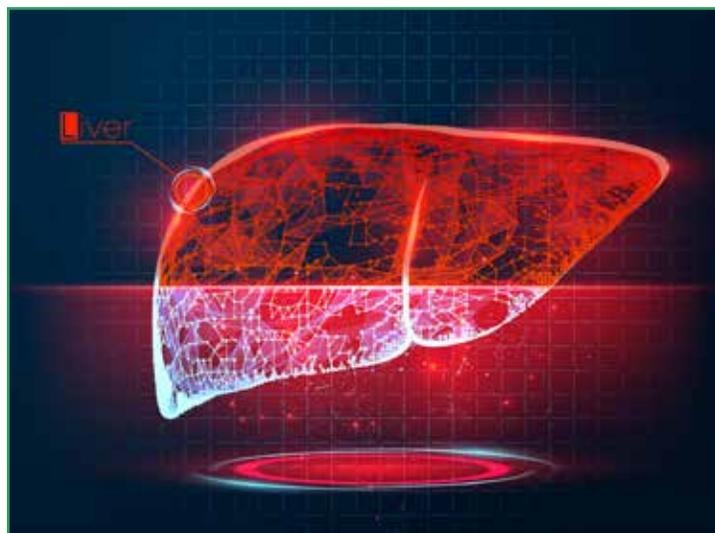
The Liver^[1]

The liver involves phase 1 and phase 2 enzymes. Phase 1 enzymes are responsible for breaking down fat-soluble toxins. Phase 2 enzymes break down these fat-soluble compounds into water-soluble compounds that are safer for the body to excrete via the kidneys. Phase 1 cytochrome P450 enzymes (CYP450) biotransform harmful substances by adding a hydroxyl, carboxyl, or amino group via either oxidation, reduction, or hydrolysis reactions. Examples of CYP450 enzymes are CYP1A/1A2 and CYP2A-E. Certain phytochemical compounds can either induce the more detoxing pathways such as phase 2 reactions, or inhibit the more harmful reactions like phase 1 enzymes.

After a toxin has passed through the CYP450 enzymes, it can then be conjugated with a water-soluble or hydrophilic substance in phase 2 detoxification. These enzymes include adding various groups such as sulfur, glutathione, glucuronic acid, amino acids, or methyl or acetyl groups.

Phase 1 toxins include xenobiotics (antibiotic compounds from the environment), steroid hormones, and pharmaceuticals.

CYP1A metabolizes procarcinogen hormones and pharmaceuticals. In particular, it also metabolizes heterocyclic aromatic amines/amides (HCAs), which are present in animal fats exposed to heat (e.g. BBQ meats).



CYP1 enzymes also form clinically relevant estrogen metabolites such as 2-hydroxy and 4-hydroxy estrogens, with 4-hydroxy having implications in estrogen-dominant cancers (e.g. breast cancer, endometrial cancer).^[2] Although these enzymes are thought of as toxin-producing and promotion of them is possibly discouraged, they still play an important role in overall toxin elimination, thus a balance of phase 1 to phase 2 enzymes is encouraged.

Nutritional Phase 1 Inducers^[3]

Nutrient inducers of CYP450 enzymes include green tea, caffeic acid in coffee, cruciferous vegetables (broccoli, Brussels sprouts, cauliflower, and cabbage), and grapefruit juice.

A clinical study found that dietary indole-3-carbinole (I3C) induces CYP1A enzymes to metabolize estrogens, making I3C from broccoli or supplement form clinically relevant for potential prevention of estrogen-related cancers. Grapefruit juice is a well-known inducer of this enzyme category and thus is discouraged to use alongside many pharmaceutical drugs that are known to increase this enzyme. Although carcinogenic compounds/reactive oxygen species are created via phase 1, their function is still relevant in order to initiate the deactivation process. It is thought that the balance of phase 1 and phase 2

is more important, promoting compounds that induce more phase 2 activity to balance out phase 1.

Nutritional Phase 1 Reducers [4]

Nutrient reducers of phase 1 include berries, quercetin, and apiaceous vegetables (carrots, parsnips, celery and parsley).

Along the lines of phase 1 inducers are certain plant compounds that can reduce the activity of the CYP450 enzymes. This is important because modern society promotes higher CYP450 or phase 1 activity, making it a clinical focus to increase foods and plant compounds that encourage phase 2 and phase 1 reduction. Examples are berries with ellagic acid inhibiting CYP1A1 overactivity, apiaceous vegetables and quercetin for CYP1A2 activity. Apiaceous vegetables include carrots, parsnips, celery, and parsley. Low-dose turmeric appears to induce phase 1, whereas higher doses may actually inhibit it. This dual relationship is seen in many plant compounds.

Nutritional Phase 2 Inducers

Nutrient inducers of transferases include cruciferous vegetables, soy foods (ex. genestein), resveratrol, citrus foods, teas (rooibos, dandelion), and spices (rosemary, curcumin).

UDP-glucuronosyltransferases, sulfotransferases, and glutathione S-transferases are the main phase 2 liver enzymes. UDP-glucuronosyltransferases add glucuronic acid to make the compound more water-soluble and excretable via the kidneys. This occurs in the liver and small intestine through the hepatocytes. Glucuronidation reactions are important for 40–70% of medications. Cruciferous vegetables, soy foods, resveratrol (in red wine), and citrus foods induce these enzymes, along with rooibos or dandelion teas, rosemary, curcumin, soy, and astaxanthin.

Nutrient inducers of glutathione include cruciferous vegetables, allium vegetables, resveratrol, spices such as curcumin and rosemary, fish oil, green tea, and citrus fruits.



Glutathione is an endogenous (naturally occurring) antioxidant. Many substances and compounds promote this enzyme activity, along with restoring it. Cruciferous vegetables, allium-family vegetables (garlic), and resveratrol are examples. Other studies show that curcumin, fish oil, green tea, and citrus, or herbs such as rosemary have also been shown to promote GST activity. Sulfur-containing foods also promote glutathione production, along with the amino acids cysteine and methionine. Sulfur foods include the cruciferous family, kale, spinach, and allium family, along with beans.

Supplement/vitamin inducers of glutathione include vitamin B₆, magnesium, folic acid, *alpha*-lipoic acid, and selenium.

From a supplement and mineral perspective, vitamin B₆, magnesium, folic acid, *alpha*-lipoic acid, and selenium may encourage glutathione synthesis. Vitamin B₆ is a cofactor in the conversion of homocysteine into endogenous glutathione. Examples of B₆-containing foods are animal products and seafood, chickpeas/legumes, sweet potatoes, and bananas. A study feeding mice a B₆- and biotin-deficient diet led to fatty liver disease. The same cannot be directly translated to humans, but is suggestive of how important B vitamins are for proper liver functioning.

Important Amino Acids

Certain essential amino acids are also required for the conjugation of enzymes. These amino acids are glycine, taurine, glutamine, ornithine, and arginine.

Examples of glycine from food are turkey, pork, chicken, and eggs; vegan sources are pumpkin seeds, beans, sunflower seeds, and lentils. Taurine is found in meat and fish. Cystine can be synthesized in the body from cysteine which requires niacin, B₆, and homocysteine. Glutamine can be found in animal products, spinach, parsley, and cabbage. Arginine is found largely in chicken, pumpkin seeds, soybeans, butternuts, eggs, peanuts, and other seeds/lentils.

Overall, it seems like a combination of many of the mentioned compounds is the best approach.

It also seems best to recommend a whole-foods approach as oppose to higher doses of a single supplement.

Other Detoxification Organs

Skin^[5]

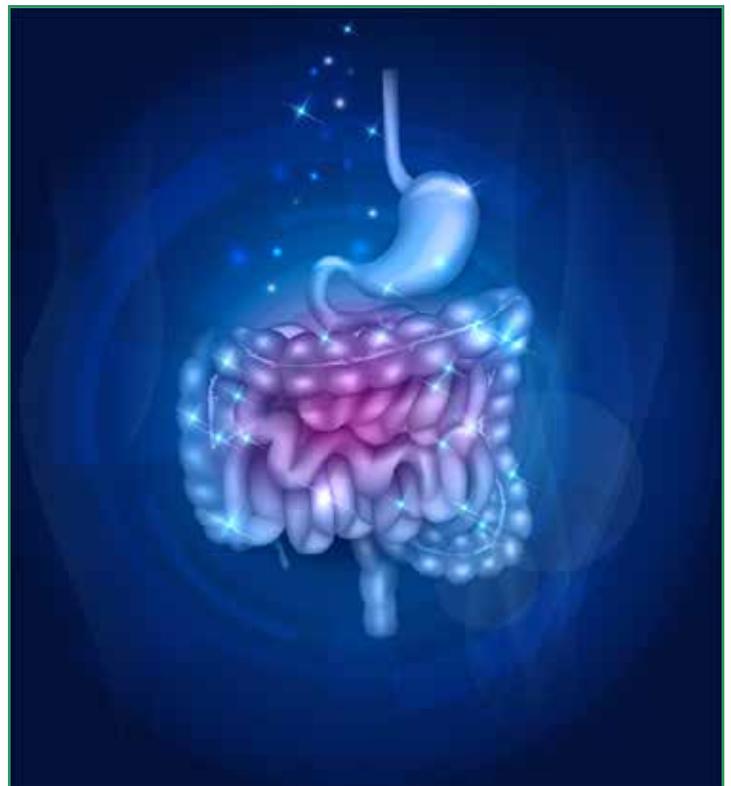
We detoxify compounds through our skin via sweat glands, and the skin, covering the whole body, is the body's largest organ of elimination. The skin can degrade, inactivate, and eliminate various xenobiotics and toxic compounds through its reactive oxygen species-scavenging system.

Beneath the skin is the lymphatic system. Unlike the blood vascular system, the lymphatic system requires movement from respiratory and skeletal muscles for movement.^[6] Certain herbs, known as lymphatics, can activate the lymphatic system by creating a pumping action. Lymphatics work as "blood purifiers" that move lymph and increase lymphatic flow moving fluid and protein away from areas of inflammation. These herbs also have laxative and cholagogue (stimulating bile duct contraction) effects which will further help with detoxification. *Rumex crispus* (yellow dock), *Iris versicolor* (blue flag), and *Galium aparine* (cleavers) are all examples of herbal lymphatics.^[7] Other lifestyle strategies such as movement/exercise,

deep breathing, hydrotherapy, massage, and dry brushing are also good supports which stimulate the muscles involved in lymphatic flow.

Bowels

Other important organs of detoxification are the intestines, particularly the large intestine/colon. According to research, intestinal immunity, microbial eradication, and toxin eradication all occur in the colon.^[8] Constipation from various reasons, such as a lack of fibre, medication side effects, or improper microflora can allow this toxin reabsorption. Inflammation, whether from an inflammatory disorder/condition such as inflammatory bowel disease (e.g. Crohn's disease, celiac disease, ulcerative colitis), food sensitivities, stress, and poor diet can all impair the body's ability to detoxify these intruders. Laxative herbs are important in this case. Examples are burdock, yellow dock, and gentian, along with flax seed, fruits/vegetables, and whole grains/oats.^[9] Burdock is a gentle stimulating laxative, unlike senna which can create dependence for regular bowel movements. Gentian is a type of bitter herb that stimulates stomach acid. This helps to promote bile and enzyme production, which absorbs fat-soluble toxins to be broken down in the liver. Exercise,



adequate fluid intake, and abdominal stretching are other gentle ways to stimulate bowel movements.

Kidney^{[10][11]}

Common botanical diuretic herbs are *Solidago* spp. (goldenrod), *Petroselinum* (parsley), and *Urtica doica* (nettle). Diuretic herbs can work either by being stimulating, osmotic, or cardiac/peripheral circulatory stimulants. Stimulating diuretic herbs work by irritating the kidneys and improving blood flow to that area. *Arctostaphylos uva-ursi* (bearberry), *Juniperus communis* (juniper), *Apium graveolens* (celery), and parsley are examples. Osmotic diuretics, on the other hand, lead to diuresis through the mucilage and polysaccharides in them, creating an osmotic pull between larger sugars passing through the urine.

Other diuretics work more on the cardiac or peripheral circulatory system. This is done via increasing renal blood flow. Examples are *Achillea millefolium* (yarrow), *Crataegus* spp. (hawthorne) and *Convallaria majalis* (lilly of the valley).

Conclusion

Poor detoxification systems can lead to fatigue, mood disorders, hormone imbalances, chronic infections, and even chronic illness over time. Incorporating exercise, stress reduction, and foods and herbs that promote healthy detoxification can lead to improved vitality in one's mind and body.

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References

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