



Toxic Substances

Exotoxins

- Environmental toxicants
- Mycotoxins
- Heavy metals
- Drugs (prescription, OTC, recreational)

Endotoxins

- End products of metabolism
- Bacterial endotoxins

LIVER DETOXIFICATION PHASES

NONPOLAR (LIPID-SOLUBLE)

MORE POLAR (LESS LIPID-SOLUBLE)

POLAR (WATER-SOLUBLE)

Lipid-soluble (non-polar) toxic substances can be stored in adipose tissue and contribute to an increased/mobilized toxin load.

PHASE 1 Bio-Transformation

Reactions

- Oxidation
- Reductions
- Hydrolysis
- Hydration
- Dehalogenation

Supportive Nutrients

- B Vitamins
- Vitamins C + E
- Zinc, Selenium, Magnesium
- Glutathione, NAC, ALA
- Bioflavonoids + Polyphenols

Intermediate Metabolites

PHASE 2 Conjugation

Reactions

- Sulfation
- Glucuronidation
- Glutathione conjugation
- Amino Acid conjugation
- Acetylation
- Methylation

Supportive Nutrients

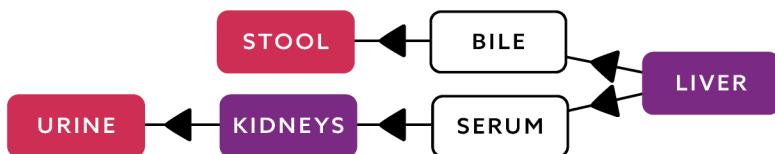
- B Vitamins
- Vitamins C + E
- Zinc, Selenium, Magnesium
- Glutathione, NAC, ALA, CDG
- Bioflavonoids, Polyphenols, Amino Acids

Superoxide

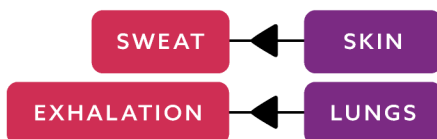
Free Radicals

Reactive Oxygen Intermediates

PRIMARY METHODS OF ELIMINATION



OTHER METHODS OF ELIMINATION



PHASE 3 Elimination

No specific reactions take place in Phase 3 detoxification but refers to the transport of conjugated metabolites out of the liver via efflux transporters activated by Nrf2 into bile or blood for excretion.

Supportive Nutrients

- Vitamins C + E
- Zinc, Selenium, Magnesium
- Glutathione, ALA, CDG
- Bioflavonoids
- Polyphenols
- Glutamine



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LIVER DETOXIFICATION

Supportive Nutrients by Phase

Review over 150 references at mosaicdx.com/resource/the-liver-supportive-nutrient-in-detoxification

VITAMINS

| SUPPLEMENT / NUTRIENT | PHASE 1 DETOX | PHASE 2 DETOX | PHASE 3 DETOX |
|---|------------------|------------------|------------------|
| B Vitamins (B2, B3, B6, B12, Folate) ^{1,2,3} | ✓ | ✓ | ✓ |
| Vitamin C ^{4,5} | ✓ | ✓ | ✓ |
| Vitamin E ^{6,7,8} | ✓ | ✓ | ✓ |

MINERALS

| | | | |
|---------------------------------|---|---|---|
| Zinc ^{9,10} | ✓ | ✓ | ✓ |
| Selenium ^{11,12,13,14} | ✓ | ✓ | ✓ |
| Magnesium ^{15,16} | ✓ | ✓ | ✓ |

KEY SUPPORT

| | | | |
|--|---|---|---|
| Glutathione ^{17,18} | ✓ | ✓ | ✓ |
| N-Acetylcysteine (NAC) ^{19,20} | ✓ | ✓ | ✓ |
| Alpha Lipoic Acid (ALA) ^{21,22} | ✓ | ✓ | ✓ |
| Calcium-D-Glucarate (CDG) ²³ | ✓ | ✓ | ✓ |
| Fiber ²⁴ | ✓ | ✓ | ✓ |
| Probiotics ^{25,26} | ✓ | ✓ | ✓ |

BIOFLAVONOIDS + POLYPHENOLS

| | | | |
|--|---|---|---|
| Cruciferous vegetables (sulforaphane) ^{27,28} | ✓ | ✓ | ✓ |
| Milk Thistle (Silymarin) ^{29,30} | ✓ | ✓ | ✓ |
| Turmeric (Curcumin) ^{31,32,33} | ✓ | ✓ | ✓ |
| Green Tea Extract (EGCG) ^{34,35,36} | ✓ | ✓ | ✓ |
| Dandelion Root ^{37,38} | ✓ | ✓ | ✓ |
| Artichoke Extract ^{39,40} | ✓ | ✓ | ✓ |
| Allium vegetables (organosulfur compounds) ⁴¹ | ✓ | ✓ | ✓ |
| Quercetin ^{42,43} | ✓ | ✓ | ✓ |
| Resveratrol ^{44,45} | ✓ | ✓ | ✓ |

AMINO ACIDS

| | | | |
|----------------------------|---|---|---|
| Glycine ⁴⁶ | ✓ | ✓ | ✓ |
| Taurine ⁴⁷ | ✓ | ✓ | ✓ |
| Methionine ⁴⁸ | ✓ | ✓ | ✓ |
| Glutamine ^{49,50} | ✓ | ✓ | ✓ |