

Minerals Involved in Detoxification

From a biochemical standpoint, the human body is designed to constantly undergo the processes devoted to detoxification. However, at this time of year, it is common to find that people want to get their bodies off to a fresh start. In order to do this, individuals will put their bodies through a variety of "health cleanses" in an attempt to rapidly rid their bodies of unwanted chemical or toxin build up, or in some cases excess weight. Some of the more popular cleanses are (from Shape Magazine 2014): *Colon Cleanse; Liver Cleanse; Master Cleanse; 10 day Green Smoothie Cleanse; Juice Cleanse; Detox Cleanse; Slendera Garcinia and Natural Cleanse; Dherbs Full Body Cleanse; Blueprint Cleanse; Isagenix Cleanse for Life*

These various cleanses are attempts to increase the rate at which the body eliminates unwanted chemicals. Unwanted chemicals are present in our food, our water, our clothing, the air we breathe, the carpet we walk on, and all the plastics found in the myriad items we use. According to a relatively new infographic called the Chemical Ape (www.collective-evolution.com), people in the United States are exposed to more than 700,000 different toxic chemicals on a daily basis. Detoxification is the body's natural, ongoing process of eliminating harmful chemical toxins from the body so that it can function properly.

When toxins enter the body, unabated, through the mouth, nasal passages, or skin, the body initially prevents pollution by surrounding the toxins with fat and water then storing them in different areas of the body. With the current amount of toxin exposure, the strain on the body's detox system can be overwhelming. The major detoxification organs or systems consist of the liver, intestines, kidneys, lungs, skin, and the lymphatics. When they become overworked, the body starts to show signs of failure. A variety of disease states can be traced to detoxification systems not being able to keep up with the elimination of toxin intake (see figure 1). The addition of a detox program to one's wellness regimen can help pull these toxins from the body. Increased intake of fluids and nutrients critical to the function of

the liver, kidneys, colon, lung, skin, and lymphatic system along with any detox program must be emphasized.

Functions of the Body's Detoxification Organs and Systems

The Liver

This organ plays the greatest overall role in detoxification, handling 70% of all detoxification. Almost 2 quarts of blood pass through the liver every minute for detoxification. Filtration of toxins from the blood coming from the intestines is critical for the removal of bacteria, endotoxins, antigens, and other ingested toxic substances (www.gilbertssyndrome.com). The liver inactivates or removes ingested toxins, such as food additives, harmful minerals, toxic medications, excess hormones, and others. The liver alone cannot filter all toxins from the blood. The detoxification process, for the most part, requires the action of two sequential steps known as Phase I and Phase II systems. Phase I either directly neutralizes the toxin, or modifies the toxic chemical to form activated intermediates which can be neutralized by one or more of the multiple Phase II enzyme systems. The liver filters a number of toxins from the blood and each day the liver manufactures about

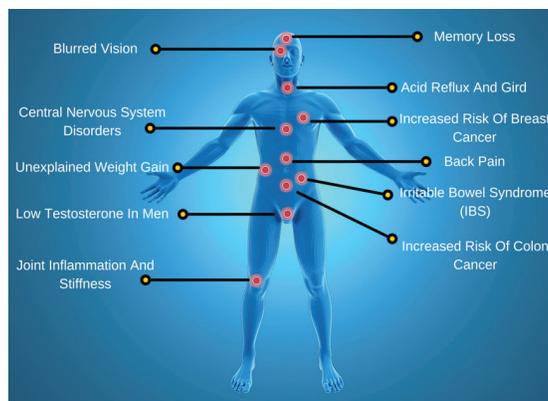


Figure 1. Dangers of Toxin Deposits
[taken from <https://drjockers.com/daily-detox.-strategies>]

a quart of bile. Bile serves as a carrier in which the toxic substances filtered by the liver are dumped into the intestines, where the bile and its toxic load are absorbed by fiber and excreted. Thus, adequate intake of fiber is of great importance to detoxification.

The liver neutralizes a wide array of toxic chemicals from both internal and environmental sources. The body's own normal metabolic functioning produces a large amount of chemicals and hormones which the liver neutralizes efficiently. However, it has been seen that the level and type of internally produced toxins increase profoundly when metabolic processes go askew. The most common cause for detoxification malfunction of the liver is the result of nutritional deficiencies. Phase I and Phase II systems, as well as biliary toxin excretion, rely on proper nutrient intake.

Phase I detoxification involves a group of enzymes commonly referred to as the cytochrome P450 family. Cytochrome P450 is composed of 50 to 100 enzymes. Each enzyme works more efficiently at neutralizing certain classes of chemicals. Phase I enzymes can directly neutralize certain chemical toxins, but in most cases they are converted to an intermediate form which can be more toxic than the initial toxin. Phase II is needed to neutralize this intermediate toxin form. Phase I enzymes achieve their toxin neutralization via reactions such as oxidation, reduction, and hydrolysis. These enzymes require several nutrients to function. The most important nutrients for the cytochrome P450's effectiveness are the minerals copper, iron, magnesium, and zinc. In Phase I neutralization reactions, the liver not only drains the compounds needed for

this detoxification system, but contributes significantly to free radical formation and oxidative stress. The more toxin exposure, the greater the need for copper, iron, zinc, and magnesium. Glutathione is the most important antioxidant for neutralization of free radicals generated in Phase I and is required for a critical Phase II detoxification. If the liver is exposed to high levels of toxins, it can produce so many free radicals in Phase I detoxification that glutathione can be depleted. In this situation, Phase II processes dependent on glutathione are terminated.

Phase II detoxification reactions typically involve conjugation of toxins with small chemicals that are attached to them by the Phase II enzymes. This conjugation either neutralizes the toxin or makes the toxin more easily excreted through urine or bile. There are basically six Phase II detoxification pathways:

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

In order to work, these Phase II enzymes require nutrients for activation and to provide the small molecules these enzymes attach to the toxins. Deficiencies or low intakes of magnesium, selenium, zinc, and molybdenum will cause Phase II enzyme systems to function poorly, if at all. The liver fulfills many vital tasks, such as digestive, hormonal and so on. It is key to the overall proper functioning of the body. There is no question that it is the body's major detoxification system. It must receive proper nutritional support to carry out all of its functions.

The Kidneys

Kidneys play the next largest role in detoxification. Kidneys are responsible for the important task of purifying the blood of toxic substances like certain medications and other harmful chemicals. Kidneys are an intricate and extremely efficient filtration system that perform many functions to keep the blood clean and chemically balanced. Kidneys filter and cleanse the body's entire blood supply 60 times per day (www.detoxandbodycleanse.com/human-body-systems/kidney-facts), removing waste from the blood and excreting it. Inside the kidneys, intricate processes take place in which water and dissolved waste materials (including toxins) leave the blood and enter the urinary system. The following processes are involved in the formation of urinary waste:

- Simple filtration - The semi-permeable walls of the glomerulus and glomerular capsule allow water and small molecules to pass freely, but larger molecules (like blood cells, plasma proteins, and others) remain in the renal capillaries.
- Selective reabsorption - The purpose of this process is to reabsorb back into the blood the filtrate components required by the body to maintain fluid and electrolyte balance, as well as proper blood pH. Foreign substances that are not normal blood constituents are not reabsorbed.
- Secretion - Those substances not required and foreign materials remaining after filtration are cleared by secretion into the convoluted tubules and from there are excreted from the body via the urinary system.

In terms of kidney function, the two most important minerals are potassium and sodium. However, kidneys play more roles than just producing urine and main-

taining proper levels of certain minerals, blood pH, and eliminating toxins. Kidneys are involved in production of things like prostaglandins, aldosterone, and renin. In this regard, magnesium and zinc are important to the kidneys' other functions.

The Intestines

The intestinal tract extends from the mouth through the colon and is involved in far more than digestion. In the digestion process, the complex molecules contained in food are transformed into much simpler molecules than our intestinal cells can absorb. Digestion begins in the mouth, continues in the stomach, and is finalized in the intestines. The nutrients comprising our food, once digested into amino acids, sugars, fats, minerals, vitamins, etc., pass through the intestinal mucosa into venous capillaries, then on to the liver. After liver detoxification, nutrients are sent into the blood stream. The various toxins, drugs, heavy metals, and other chemicals are sent by the liver into the bile. Bile plays an important role in the elimination of toxins from the liver and in the digestion of fats. The final phase of alimentation and elimination of toxins is in the intestines, after all the useful nutrients have been absorbed through the intestinal mucosa, due to action of the microflora. At this point all the insufficiently digested, large alimentary molecules and toxins are excreted with the fecal matter.

In covering the detoxification activities of the liver, kidneys, and intestines the vast majority of the body's detoxification has been reviewed. Other organs or systems involved in detoxification, like the respiratory tract, skin, and lymphatics, play much lesser roles in detoxifica-

tion (www.Issels.com/publication-library/information-on-detoxification)

The respiratory tract consist of lungs and bronchi. For the most part the respiratory tract evacuates toxins in the form of carbonic gas. They may also excrete phlegm. Normally, the alveoli of the lungs do not let solid waste material penetrate. Due to the constant irritation from toxic air and infectious microbes, the alveoli can become porous and can act as an extra exit for toxins that the liver, kidneys, and intestinal tract could not eliminate. Magnesium is important to lung function, playing important roles in the provision of energy and muscle function needed for breathing. Potassium also plays a role in the muscle function.

Skin is the largest organ, and in addition to governing thermal regulation, it protects the body from toxins and plays an important role in the elimination of toxins. Specifically, the skin evacuates waste products that are classified as crystals. Crystals are the residues of the metabolism of foods rich in protein. They are liquid soluble, and the skin evacuates them via the sweat glands. Zinc and selenium play key roles in providing antioxidant protection for skin from free radicals and different forms of radiation (such as that produced by the sun).

The lymphatic system is part of the circulatory system, and plays key roles in detoxification and immunity. Lymphoid tissues include the lymphatic vessels, lymph nodes, thymus, bone marrow, and spleen. The immune processes of the lymph system are quite complex. Thymus, spleen and lymphatic glands are heavily involved

in the body's immune system. It is in the lymphatic glands that lymphocytes (white blood cells) are produced. About two to three liters of lymph fluid circulate in the lymphatic vessels. This fluid is formed continuously from the interstitial fluid - extra cellular fluid surrounding all of the cells in the body. This extracellular fluid penetrates the capillary membrane, keeping the volume of lymphatic fluid constant and allowing waste products to leave the cells and then carried away to the venous system and evacuated, helping to detoxify the body. There are a number of minerals involved in the lymphatic system. However, it has been shown that deficiencies of the minerals magnesium and zinc cause poor functioning of the lymphatic system.

Summary

In this review of the body's organs and systems of detoxification, you can see there are key roles played by various minerals in each of the body's detoxification processes. Of course, all of the nutritional minerals are of importance. However, when it comes to detoxification, magnesium and zinc appear to be of prime importance, along with selenium.

When you are looking to formulate products to aid in detoxification, look to Albion minerals for the best performing mineral supplementation.

- High bioavailability
- Easy to tolerate
- High degree of safety
- No mineral to mineral or food absorption inhibition

ALBION[®] RESEARCH NOTES

Albion Research Notes
is a publication of

BALCHEM
Human Nutrition & Pharma

©2018 Albion Laboratories Inc. All rights reserved.

March, 2018 Volume 27, No 1

RESEARCH NOTES

