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Health Concerns

Page: [1](#) | [2](#) | [3](#) | [4](#) | [5](#) | [6](#)



Heavy Metal Toxicity

Glutathione

Glutathione is a tripeptide (chain of amino acids) that functions as a modulator of cellular homeostasis (the orderly status of cell life), including detoxification of oxyradicals and carcinogens. If glutathione is depleted, an organism can be predisposed to incur stress from pollutants (Ringwood et al. 2000). Glutathione and glutathione-related enzymes are important antioxidants. These enzymes appear to play an important role in detoxifying carcinogens (Chouchane et al. 2001; Lorico et al. 2002; Maiti et al. 2001).

Glutathione status has also been shown to have an impact on the ability of the body to handle heavy metals such as cadmium, lead (Daggett et al. 1998; Wright et al. 1998), iron, and mercury. The pro-oxidative effects of heavy metals are compounded by the fact that they also inhibit antioxidative enzymes and deplete intracellular glutathione. Heavy metals also have the potential to disrupt the metabolism and biological activities of many proteins because of their high affinity for free sulfhydryl groups. When glutathione status is elevated or increased by supplementation and there is exposure to cadmium, lead, iron, or mercury (either independently or along with nutrients such as zinc or selenium), the tissues that were exposed were able to stop damage by the lipid peroxides that were created by exposure to the metals (Shukla et al. 1988; Turan et al. 1992; Sidhu et al. 1993; Tang et al. 1998; Tjalkens et al. 1998; Shaikh et al. 1999a). Interestingly, in a study in rats, Wright et al. (1998) concluded that their results indicated increases in renal glutathione (glutathione S-transferase or GST) "occur at levels of lead that are environmentally significant and that these changes precede cellular damage." Wright et al. (1998)



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suggested that GST "may serve as a tissue biomarker of lead exposure."

Additionally, glutathione appears to play a major role in arsenic toxicity (Maiti et al. 2001; Chouchane et al. 2001; Lorico et al. 2002). It is the most abundant cellular thiol in the body (Chouchane et al. 2001). Arsenic toxicity appears to be a result of the ability of arsenite to bind to protein thiols, causing the thiols to be unavailable for detoxification activity. Couchane et al. (2001) examined the effect of arsenic on the activity of a variety of glutathione enzymes but concluded that many more studies are needed to understand the relationship between glutathione-related enzymes and the products of arsenic metabolism in the role of arsenic toxicity and carcinogenesis. However, Lorico et al. (2002) stated: "These observations further demonstrate that glutathione is an important component of MRP1-mediated cellular resistance to arsenite and antimony."

Glutathione is also closely tied to immunity, protecting the cells and assisting the liver in detoxifying harmful compounds and toxins. When taking glutathione, vitamin C is also recommended because vitamin C assists glutathione in maintaining its powerful free radical-suppressing effects.

Lactoferrin

Lactoferrin, a natural component of cow and human milk, is a subfraction of whey with well-documented antiviral, antimicrobial, anticancer, and immune modulating and enhancing effects. However, lactoferrin's best-known role is as an iron-binding protein. Lactoferrin acts as an antioxidant, scavenging free iron and helping to prevent uncontrolled iron-based free radical reactions. Interestingly, although lactoferrin is both an iron scavenger and donor (depending on the cellular environment), it has been found to scavenge or donate iron appropriately depending on what the body needs at any given time. At normal physiological pH, lactoferrin binds tightly to iron, diminishing oxidative stress to tissues (Brink 2000). Stella et al. (1995) examined the role of whey proteins, multifermented whey proteins, and lactoferrin in oxidative stress and made this bold statement: "We can conclude that whey protein, lactoferrin and multifermented whey are good candidates as dietary inhibitors of oxidative stress and should be considered as potential medicinal foods in various pathologies as HIV infection and cancer."

Selenium and Zinc

Deficiency of selenium and zinc, important antioxidant micronutrients, contributes to compromised immunity (Girodon et al. 1999) and lowered defense against free radicals (Porter et al. 1999; Schumacher 1999). Selenium and zinc act as cofactors of antioxidant enzymes to protect against oxygen free radicals produced during oxidative stress (Leung 1998). Selenium is often found to be deficient in persons who have experienced physical trauma. Porter et al. (1999) concluded that patients who experienced severe trauma had fewer infections and less organ dysfunction when they received selenium supplementation. Interestingly, studies on the protective benefits of selenium have implications in the management of persons receiving chemotherapy, enhancing mediation of oxygen free-radical damage to normal tissue, and decreasing side effects such as nausea, emesis, vertigo, unsteady gait, and seizures caused by the chemicals and drugs used in chemotherapy (Pakdaman 1998). This is possibly a characteristic of persons with brain tumors who frequently have low blood levels of selenium (Pakdaman 1998; Schumacher 1999).

Herbs

Herbs and herbal extracts have been used for decades and studied for years, particularly in Europe and China (Huang 1993). Many drugs commonly used in modern-day medicine have been derived either directly or indirectly from herbal origin. Herbs are often complexed (combined) to assist in blood purification and detoxification (e.g., dandelion root, yellow dock root, sarsaparilla root, echinacea, licorice root, etc.) (see the [Gulf War Syndrome](#) Protocol for additional information on detoxification with herbs).

Cilantro

Coriandrum sativum is a European herb in the parsley family. The leaves are cilantro (also Chinese parsley) and the fruit is coriander. Cilantro leaves are commonly used as a seasoning herb. However, dried coriander seeds have an entirely different flavor than the leaves and are used as a spice. Coriander stimulates appetite, helps increase secretion of gastric juices, and aids the digestive system. The essential oils of cilantro are considered to have

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antifungal and antibacterial properties (Omura et al. 1995; 1996).

In studies at the Heart Disease Foundation (New York), Omura et al. (1995; 1996) found that antibiotics used to treat infection were not effective in the presence of heavy metals such as mercury and lead. These metals appeared to coexist with infections such as Chlamydia trachomatis and Herpes simplex, as well as with cytomegalovirus and other microorganisms, including viruses responsible for cancer. Even with rigorous treatment and taking precautions to guard against reinfection, patients often had a recurrence of infection within several months after treatment was completed. However, quite by chance (after eating soup containing cilantro) and as the result of his own experience following a cardiac thallium study, Omura found that cilantro successfully eliminated mercury deposits (mercury resulted as a decay product of thallium). Omura et al. (1995) then gave subjects a course of either antibiotics or antiviral drugs along with cilantro. The amount of cilantro varied by individual because some subjects did not like either cooked or raw cilantro, but the researchers found that cilantro worked synergistically with antibiotic drugs and rapidly reduced symptoms and infection. They also found that cilantro accelerated the elimination of mercury, lead, and aluminum through the urine. They hypothesized that certain infectious organisms somehow use mercury or lead to protect themselves from antibiotics or that deposits of heavy metals somehow make antibiotics ineffective.

The next year, the same researchers (1996) investigated the potential health hazard of mercury in dental amalgam. In this case study, they monitored a patient who was having amalgam fillings removed. Even though considerable care was used so that the patient would not swallow minute particles of amalgam during the removal process (drilling), significant deposits of mercury were still found in the patient's lungs, kidneys, liver, and heart. These deposits were not present prior to the amalgam removal. However, the mercury deposits were eliminated by taking oral cilantro four times a day. Omura et al. (1996) initiated cilantro detoxification treatment before the removal procedure and continued it for about 2-3 weeks afterward.

Garlic

Garlic has been valued for centuries for its medicinal properties. Research has shown that garlic can protect us from various pollutants and heavy metals (Cha 1987). Garlic is also important for its ability to prevent certain kinds of cancer, prompting the National Cancer Institute to develop a \$20.5 million program to study plant-derived compounds in common foods that may have cancer-prevention effects. Some scientists speculate that garlic may protect against cancer by its ability to help the body to inactivate and eliminate cancer-causing substances without damage. Depending on personal requirements or preferences, garlic supplements are available in a wide range of potencies. The aged form of garlic (Kyolic) is organically grown and then harvested and aged to produce a mild, odor-free garlic extract.

Green Tea

Green tea is a powerful antioxidant that may protect cells from mutation caused by cancer-causing agents and damage caused by free radicals. For years, studies conducted in Japan demonstrated that persons who consumed green tea had a lower incidence of several types of cancer (stomach, liver, pancreas, breast, lung, esophagus, and skin).

Minerals

In addition to the vitally important function of maintaining healthy bones and helping to restore bone density if it has been lost, calcium is required for proper liver function. The kidneys assist in processing body waste; however, the liver is the organ that has the primary function of processing body waste. Additionally, through complex chemical processes, the liver is also responsible for providing building and maintenance materials for all other organs and tissues in the body, providing vital digestive enzymes, and storing glucose not immediately needed by cells (Clayman 1999). Adequate absorption of calcium can be compromised by an existing condition of the liver or the intestinal tract. To aid optimized liver function, ensure that adequate dietary calcium is provided.

Essential Amino Acids

Amino acids are the basic chemical "building blocks" of life that are derived from dietary protein that is broken down into individual amino acids by the

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body. The body then reassembles the amino acids into new and vital structures that are essential to produce protein structures for genes, enzymes, hormones, body fluids, and neurotransmitters (Clayman 1989). A deficiency in essential amino acids can negatively affect protein synthesis. Exposure to pollution, chemicals and agricultural pesticides are environmental sources that contribute to a deficiency of amino acids. L-cysteine and the acetylated form, N-acetyl-cysteine (NAC), act as antioxidants and liver protectants. When taking L-cysteine or NAC, taking vitamin C will help maintain their powerful free radical-suppressing effects.

Cysteine and N-Acetyl Cysteine (NAC)

L-cysteine is a conditionally essential amino acid, one of three sulfur-containing amino acids. The other two are taurine (produced from L-cysteine) and L-methionine. L-cysteine can be produced from L-methionine in the body by a complex multistep process. L-cysteine acts as an antioxidant and has a pivotal role in inducible, endogenous (internal) detoxification mechanisms in the body. Exposure to metals taxes our supply of cysteine (Quig 1998).

N-acetyl-cysteine (NAC) is the acetylated (or combined) form of L-cysteine, which is more efficiently absorbed and used. NAC works in the extracellular environment and is a precursor of intracellular cysteine and glutathione. NAC has been used as a liver protectant, as well as to break up pulmonary and bronchial mucus. From decades of experience, NAC has been shown to be a safe and effective prophylaxis (prevention agent) and therapy for a variety of conditions, even in very high doses, mostly involving glutathione depletion and alterations of the redox status (De Flora et al. 2001).

- **Note:** Redox = red(uction) + ox(idation).

NAC has an impressive list of protective effects: antioxidant activity, decrease of the biologically effective dose of carcinogens, anti-inflammatory activity, immunological effects, inhibiting progression to malignancy, inhibiting metastasis, and protection from the adverse effects of chemopreventive and chemotherapeutic agents. Although their studies were primarily directed at chemoprevention treatment and complementary approaches in high-risk individuals (e.g., people who smoke or who are ex-smokers), according to De Flora et al. (2001), "There is overwhelming evidence that NAC has the ability to modulate a variety of DNA damage and cancer-related end-points."

Glycine

Glycine is another conditionally essential amino acid found in plant and animal protein. Chemically, glycine is the most simple and most ubiquitous (seemingly present everywhere) of all of the amino acids. It combines with many toxic substances and converts them to harmless forms, which are then excreted from the body. Glycine has a calming effect on the brain. It may also be a growth hormone releaser. (Along with cysteine and glutamic acid, glycine is also a component of glutathione.) In a study of the Japanese drug, Stronger Neo-Minophagen C, a drug containing glycine, glycyrrhizin, and cysteine, which is said to be protective against chronic cadmium toxicity, Shaikh et al. (1999b) concluded that the reported beneficial effects of Stronger Neo-Minophagen C were from glycine. Glycine appeared to reduce the oxidative stress of chronic cadmium toxicity. However, as of spring 2002, Stronger Neo-Minophagen C was not available in the United States (www.fda.gov).

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Alfalfa

Although most people consider alfalfa to be a plant that is primarily grown for animal feeds, and it has been widely studied for that purpose, alfalfa (also called buffalo herb, buffalo grass, Chilean clover, lucerne, and purple medic) is an excellent source of protein for humans. Alfalfa is high in vitamins A, D, E, B6, and K; calcium, magnesium, chlorophyll, phosphorus, iron, potassium, trace minerals; and several digestive enzymes. Alfalfa is also a high-fiber substance (21% crude fiber, 42% dietary fiber). High-fiber diets are generally recommended for reducing cholesterol, improving diabetes, and protecting against colon cancer. As early as 1981, researchers found that--because of its high-fiber content--alfalfa has properties to bind to material in the colon and aid in its removal (Smith-Barbaro et al. 1981). More studies are required, however, to determine if alfalfa has an ability to induce activity in a complex cellular system to inactivate dietary chemical carcinogens in the liver and small intestine and remove them before they have a chance to cause harm to the body.

Alfalfa should not be taken by individuals with toxic or chronic iron overload.


Chlorella

Chlorella is a single-cell, fresh water algae that is rich in protein, vitamins, minerals, chlorella growth factor, and other beneficial substances. It is about the size of a human erythrocyte (red blood cell) or about 2-8 microns in diameter. Chlorella is high in chlorophyll, giving it a rich green color. For many years, chlorella has been accepted as a detoxifier, and it is commonly used in colon cleansing regimes. Chlorella appears to bind to heavy metals as well as other toxic substances in the bowel and help with the detoxification process. Chlorella also increases serum albumin levels that are necessary for optimum health.

Many reports have come from Japanese research studies that followed the nuclear catastrophe resulting from atomic bombs that were dropped on the cities of Hiroshima and Nagasaki in 1945. In a report to the General Meeting of the Pharmaceutical Society of Japan on an early study in animals, Ichimura (1973) reported that chlorella (8 grams daily) increased elimination of cadmium: threefold in feces and sevenfold in urine. Other researchers from Japan showed that chlorella helped detoxify uranium and lead (Horikoshi et al. 1979). Chlorella has detoxification potential for similar compounds, such as dioxin and polychlorinated biphenyls. (PCBs are chemical compounds used in plastics, insulation, and flame retardants, with potential to cause cancer and liver damage.) Other research indicates that chlorella is useful in detoxification of high levels of mercury in the body caused by removal of mercury amalgam. Some dentists recommend chlorella to patients who are having mercury amalgams replaced (as well as to themselves and staff who can incur accidental exposure from day-to-day exposure to amalgam filling procedures) (O'Brien 2001).

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