Heavy Metals and Fulvic Acid

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December 2021

Heavy metals can be divided into two main categories. I) The essential or friendly heavy metals that function in critical biochemical and physiological processes within our bodies and are protective. These heavy metals are essential for life. II) The toxic or unfriendly heavy metals that disrupt and poison critical biochemical and physiological processes and are toxic to life [1, 2].

The protective heavy metals include copper, cobalt, iron, nickel, magnesium, molybdenum, chromium, selenium, manganese, and zinc have critical functional roles which are essential for various diverse physiological and biochemical activities in the body. For example, metalloenzymes (enzymes that contain essential heavy metals) are proteins within our cells that serve to perform essential biochemical functions required for life. These friendly heavy metals are intimately assimilated into the metalloenzyme providing it with essential structural and functional integrity. Without the essential heavy metals, the metalloenzymes three-dimensional structure would be critically disrupted and unable to form and function properly. Life as we know it today depends upon the essential heavy metals.

The toxic heavy metals include cadmium, mercury, lead, chromium, silver, and arsenic, and in minute quantities have deleterious effects in the body causing acute and chronic toxicities in people. Toxic heavy metals can bind where they are not meant to, for example to metalloenzymes causing them to misfold and misfunction and if the toxic metal concentration is high enough can ultimately lead to death [1, 3].

Both essential and toxic heavy metals are naturally present in our environment. They are present in soils, bodies of water, our air and in our food and water. Toxic heavy metal exposure can occur through various routes including air pollution, food and water, occupational processes, and cigarette smoke among others. Although toxic heavy metals are present in the ecosystem, their exposure to humans is through various environmental pollutants that are primarily a result of activities of man [3].

Toxic heavy metals can accumulate in plants, animals, and aquatic organisms. They accumulate in a stepwise manner in algae, shellfish and fish, and finally reach the human body through the food chain. This is why the EPA sets suggested limits on eating larger fish species, such as swordfish, since they are higher up on the food chain they have accumulated more of the toxic heavy metal mercury that can be passed on to people who eat swordfish. Therefore, it is important to be mindful about the association between what we eat and the potential for the accumulation of toxic heavy metals in our bodies. You can certainly eat swordfish, however, the suggested intake should definitely not be everyday (https://www.epa.gov/fish-tech/epa-fda-fish-advice-technical-information).

Each of us have small measurable quantities of toxic heavy metals present in our body. This "background level" of heavy metals in our bodies is normal and the resultant oxidative stress generated by these heavy metals is normally mitigated by our naturally produced antioxidants within our cells [2].

Antioxidant Activity

At the cellular level, toxic heavy metals cause oxidative damage to the cellular macromolecules including enzymes and cellular structures such as the cell membrane. Oxidative stress is essentially an imbalance between the production of free radicals and the ability of the body to counteract or detoxify their harmful effects through neutralization by antioxidants. Toxic heavy metals generate free radicals which are closely associated to oxidative stress, oxidative damage and disruption of enzyme activity. These are the main mechanisms by which toxic heavy metals exert toxicity. A free radical is an oxygen containing molecule that has one or more unpaired electrons, making it highly reactive with other molecules. Heavy metals are reported to disturb the oxidative/antioxidative balance leading to oxidative stress and oxidative damage caused by free radicals to the cellular macromolecules. These macromolecules include lipids, proteins, deoxyribonucleic acid – DNA, cellular and intracellular membranes, and cellular organelles [1].

Recognizing the role of oxidative stress in the process of aging and various pathological processes, including unfavorable effects of exposure to xenobiotics (substances foreign to the body), resulted in growing interest in the role of antioxidants not only in the pathogenesis of these states, but also in their prevention and treatment. Antioxidants offer protection against the pro-oxidative mechanism of heavy metal toxicity, including free-radical formation, and have the ability to help counteract heavy metal-induced oxidative stress and its consequences [4, 5].

Antioxidants, such as those naturally generated by our bodies, are protective against oxidative damage by neutralizing free radicals. When we are challenged by environmental insults such as air pollution or exposure to toxic heavy metals our bodies naturally produced antioxidants may not be capable of sufficiently mitigating all the resultant oxidative stress. This is where externally supplied antioxidants, such as those contained in fruits and vegetables, or from fulvic acid supplements such as MLG-50®, are capable of scavenging harmful reactive oxygen species (ROS) subsequently reducing the oxidation of cellular molecules, thus alleviating oxidative stress [6, 7]. When antioxidants generated by our body are not enough, antioxidants obtained through the diet or from fulvic acid supplements can be essential in supplying an adequate level of antioxidants for the alleviation of oxidative stress in our body. As always, a mindful nutritious diet along with regular exercise are key factors towards maintaining a strong and healthy body.

References

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