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Heavy Metal Toxicity

MSM (Methylsulfonylmethane)

Methylsulfonylmethane or dimethyl sulfone (MSM) is a naturally occurring sulfur compound. Dimethylsulfoxide (DMSO) and dimethylsulfide (DMS) are closely related compounds. In its purified form, MSM has no odor and is a slightly bitter tasting, water-soluble, white, crystalline powder that contains 34% elemental sulfur (chemical formula of $[\text{CH}_3]_2\text{SO}_2$). The origins of MSM begin with the phytoplankton in the ocean. DMS is produced through a complex process occurring in the ocean. DMS escapes as a gas and rises into the upper atmosphere. (Some atmospheric chemists suggest that MSM and its related compounds, DMSO and DMS, are the source of 85% of the sulfur compounds in all living organisms.) In the atmosphere, DMS is oxidized by ozone and ultraviolet light into its chemical cousins, DMSO and MSM. DMSO and MSM return to the earth in rain, where they are absorbed by the soil. Then plants rapidly take up the two compounds and concentrate them. Next, animals eat the plants, which completes the cycle (Prater 1999).

Therefore, as a result of the cycle that began with phytoplankton, MSM occurs naturally in the human body as a result of the food we eat. It is a normal component of fresh fruits, vegetables, seafood, and meat and can also be found in tea, coffee, and chocolate. MSM can be detected in the circulatory system (about 0.2 ppm in a normal adult male) and in human urine. Normal adult humans excrete from 4-11 mg of MSM each day in their urine. The concentration of MSM decreases with age in vertebrates. Therefore some research suggests there is a minimum concentration of MSM that must be maintained in the body to preserve normal function and structure (Prater 1999).



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Chelation involves a sulfur donor (Esteves et al. 2000). Because MSM is a compound that contains sulfur, theoretically it could be beneficial as a part of a detoxification protocol for heavy metals (e.g., there is a sulfur component in glutathione, methionine, cysteine, and NAC). After administering cadmium to rats, cysteine and methionine were given in combination. Esteves et al. (2000) found that cadmium was removed from the circulatory system, preventing its deleterious effects. In addition to its detoxifying potential, MSM has potential for allergy response reduction, control of hyperactivity, constipation relief, cancer prevention, and inflammatory conditions, such as rheumatoid and degenerative arthritis (Prater 1999).

Rutin

Rutin is a phytoextract (plant extract) found in many plants, particularly buckwheat. Other rich sources of rutin are black tea and apple peel. Rutin is thought to have antioxidant, anti-inflammatory, anticarcinogenic, and cytoprotective activities (Deschner et al. 1993; Perez Guerrero et al. 1994; Kostyuk et al. 1996; Galvez et al. 1997; Cruz et al. 1998). Studies in animals demonstrated that rutin has anti-inflammatory potential in colitis, reducing tissue damage (Galvez et al. 1997; Cruz et al. 1998). Kostyuk et al. (1998) reported free-radical scavenging and iron-chelating ability that significantly protected against cellular damage.

Dietary Fiber

Choosing foods with high fiber content and supplementing the diet with additional fiber (e.g., psyllium, acacia, apple pectin, and oat and wheat bran) aid the body in ridding itself of toxins. When adding fiber to your diet, use small amounts at first so that your digestive system can adjust to the added fiber. If gas or bloating occurs, reduce the amount until tolerance is achieved.

Protective Agents

- [SAmE](#)
- [Silibinin](#)

SAmE

SAmE or S-adenosylmethionine (also known as SAM or AdoMet) has been called "the liver's super-nutrient." Nothing else comes close to SAmE in providing a spectrum of health benefits for the liver. As a preventive agent, SAmE is so powerful that it can reverse the destructive effects of chemicals and alcohol as they occur. It also has a central role in liver biochemistry. SAmE performs two crucial functions: methylation and trans-sulfuration. One result of trans-sulfuration is a transformation into glutathione, the liver's most vital substance. Glutathione is crucial for liver function and is a natural antioxidant for the liver. Because the liver also contains the third highest amount of SAmE in the body (after the adrenal and pineal glands) and because SAmE is so important for liver function, SAmE can be considered to be an essential nutrient for the liver.

The principal function of the liver is to break down damaging substances encountered by the body (drugs, alcohol, infections, or even our own body products). Therefore, poor liver function is invariably accompanied by glutathione depletion. In addition to its many other functions, SAmE also plays a leading role in liver regeneration. Anyone concerned about the effects of drugs, toxic chemicals, alcohol, and aging on the liver should consider taking SAmE for its protective benefits.

Several studies were conducted to investigate the role of SAmE in arsenic toxicity (Yamanaka et al. 1997; Tripathi et al. 1998; Goering et al. 1999). A study by Goering et al. (1999) demonstrated that arsenic interferes with DNA methyltransferases, causing the tumor suppressor genes to be inactivated. The study suggests that arsenic-induced malignant transformation is linked to DNA hypomethylation subsequent to depletion of SAmE, potentially resulting in aberrant gene activation, including cancer genes. Note: In methylation, a compound is derived from ethanol in which hydroxyl hydrogen is

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replaced by a metal.

Gubrelay et al. (2001) conducted a study in mice to determine the role of SAME to increase removal of cadmium from target organs by diethylenetriamine penta acetic acid (DTPA). Their results indicated that there was significant removal of cadmium concentration from the blood in DTPA-plus-SAME-treated animals compared to either one of the substances alone. Gubrelay et al. (2001) also found that treatment with SAME alone was effective in correcting zinc and glutathione concentrations.

As early as 1985, research was being done in mice to investigate the beneficial effects of SAME on acute and chronic lead exposure (Paredes et al. 1985). The mice were treated with subcutaneous SAME for 20-22 days. In all test subjects, there was significant recovery of erythrocytic (red blood cell) ALA-D following SAME therapy. There was also decreased lead content in blood, liver, and kidneys, with near normal levels attained in 2 weeks. Glutathione (GSH) concentration in blood and liver that had been diminished also increased after SAME administration, reaching normal levels.

Silibinin

Silibinin (also silybin) is the most biologically active ingredient in silymarin. Silymarin is an extract derived from the herb milk thistle (a member of the Compositae or daisy family). Silymarin and its main active ingredient, silibinin, help prevent toxic liver damage. Standardized milk thistle extract usually consists of a minimum of 35% silybin (by HPLC analysis).

A recent study by Skottova (1999) compared the effectiveness of silymarin with silibinin to inhibit copper-induced oxidation of low-density lipoproteins in vitro. Silymarin and silybinin were found to be equally effective in prolonging the initial "lag phase" (the slow stage of the oxidation process). As a result, Skottova concluded that "silybin is the most important compound of silymarin in protecting the LDL from oxidation."

There have been a few studies to investigate the activity of silibinin on heavy metals. This research supports the use of silibinin as an adjunct for liver, kidney, pancreas, and other organ support in any heavy metal detoxification program. The importance of silibinin for heavy metal detoxification is in its ability to aid liver function and regeneration (Pietrangelo et al. 1995; Wellington et al. 2001), elevate glutathione enzyme levels (Gonzalez-Correa et al. 2002), reduce oxidation (Pietrangelo et al. 1995; Skottova et al. 1999), and improve cellular thiol status (Tager et al. 2001).

However, if the liver has already been damaged by toxic substances, silymarin and silibinin can help speed up liver regeneration. Silymarin and silibinin actually accelerated the rate of protein synthesis in the liver, leading to faster cell regeneration (Sonnenbichler et al. 1986; Valenzuela et al. 1994). At the Max Planck Institute for Biochemistry in Germany, Sonnenbichler et al. (1999) discovered that silibinin also protected the kidneys from toxic injury and produced accelerated kidney regeneration after toxic damage (e.g., from agents such as chemotherapy drugs). Because the kidneys can be damaged by analgesics, chemotherapy drugs, and other toxic substances, the finding that silibinin has protective benefits and even stimulates regeneration has tremendous clinical interest.

Conclusion

For most people, acute heavy metal toxicity will rarely be a concern or pose a problem. However, certain groups are at a higher risk:

- Those who live in homes that contain lead pipes and lead-based paint or in areas having high environmental levels of elemental mercury, iron, or aluminum
- Those who work in industries that manufacture batteries, pesticides, and fertilizers or who are members of their households
- Those who work in industries that are involved in metal finishing
- Those who handle chemicals in scientific or laboratory settings

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Exposure to heavy metals can be considered acute from an accident or chronic from long-term exposure. Unrecognized or untreated toxicity will likely result in illness and reduced quality of life. Testing is essential if you suspect you or someone in your household might have heavy metal toxicity. If test results are positive, initiation of appropriate conventional and natural medical procedures described earlier in the protocol might be required. However, there are many proactive things you can do to provide yourself with natural chelating, detoxifying, anti-inflammatory, and antioxidant qualities and to aid your vital organs in performing at their best.

SUMMARY

If you suspect you have heavy metal toxicity, consult your personal physician. If you have a specific medical condition or are taking prescription medicine, you must also consult your personal physician about possible contraindications for your condition or possible drug interactions before using any suggested product. More aggressive treatment approaches for chelation therapy require the supervision and monitoring by a qualified medical health professional.

Observe workplace safety rules and follow procedures to protect yourself in the workplace. When leaving the workplace, follow decontamination procedures to avoid wearing contaminated clothing that could potentially expose other persons, particularly children in the home. At home, raise your awareness of potential sources of exposure to toxic materials. Take measures to limit access to toxic products. Whenever possible, replace toxic products with less dangerous alternatives. Properly dispose of those that are no longer needed. Learn to recognize the symptoms of ingested toxic substances. Learn first aid procedures. Display emergency contact numbers by the telephone.

Strive to achieve proper, balanced nutrition by choosing fresh (organic when possible) fruits, vegetables, grains, lean meat, and cold-water fish.

Consider taking supplemental antioxidants, herbs, minerals, amino acids, phytoextracts, detoxifying agents, protective agents, and fiber as adjuncts to a healthy diet to enhance vital organ functioning and to aid in your body's natural detoxifying actions. The dosage recommendations listed below are for healthy persons.

1. Life Extension Mix provides a convenient source of vitamins, trace minerals, amino acids, and herb extracts. The recommended dose of Life Extension Mix is 3 tablets taken 3 times daily.
2. Life Extension Booster contains three forms of selenium, vitamin E, and other important nutrients. The suggested dose is 1 capsule daily with any meal.
3. Vitamin C is an antioxidant known for its immune and oxidative benefits. A prophylactic dose of 2.5-6 grams daily from all of the various forms of vitamin C (including dietary sources) is recommended. Vitamin C may cause gastric upset for some people. Taking vitamin C with meals may alleviate gastric upset, as might using an antacid, buffering agent, or a buffered form of vitamin C.
4. Vitamin E has known antioxidant, immune enhancement, and cardiovascular benefits. The suggested dose is one 400-IU capsule daily. For therapeutic use, a dose of 1-5 capsules taken with meals is suggested.
5. Vitamin A has important antioxidant properties and proven benefits for cancer and heart disease prevention. A daily dose of one to two 25,000-IU capsules is recommended.
6. Glutathione is one of the body's most powerful antioxidants. A daily dose of two to six 750-mg capsules daily is recommended.
7. Selenium is an essential micronutrient that is important in immune and antioxidant functions. A recommended daily dose is one 200-mcg capsule of selenium.
8. Zinc is another essential micronutrient that is important in immune and antioxidant functions. One 30-mg capsule of zinc daily is suggested.
9. Lactoferrin is known for its ability to have an affinity for iron. One 300-mg capsule of Lactoferrin daily is recommended as a dietary supplement.
10. Garlic has been used for centuries for medicinal purposes and has proven protective benefits from pollutants, heavy metals, and cancer-causing substances. A recommended dose is two 200-mg capsules taken with meals.

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11. Consider using cilantro. Cilantro is readily available from high-quality produce sources or as oil that can be rubbed into the skin. Steep 1-15 drops in hot water 2 times daily (5 days on, 2 days off). During mercury chelation therapy, stop using cilantro after 2 weeks or on the day therapy begins during the third week.
 - o Keep cilantro out of the reach of children. If you have any discomfort after taking cilantro, discontinue using it orally and try using cilantro oil on your skin (1 drop on the wrist twice daily).
12. Green tea has been demonstrated to be a powerful antioxidant. For protective purposes, one 725-mg capsule daily is suggested. For therapeutic purposes, consider taking two capsules.
13. Calcium is an essential mineral for maintaining healthy bones as well as having properties that block the absorption of free radical-generating iron into the bloodstream. Depending on individual requirements, 1000 mg is a beginning dose of supplemental calcium. A daily dose of one to two 1000-mg capsules is suggested. For those who have a low calcium-content diet or who do not take other calcium supplements, consider taking more. Calcium absorption and utilization is enhanced by also taking vitamin D3. It is recommended that calcium be taken daily in divided doses.
14. L-cysteine, N-acetyl-cysteine, and glutathione are important antioxidants. When taking L-cysteine, N-acetyl-cysteine, or glutathione, it is recommended that vitamin C also be taken to help maintain their powerful free radical-suppressing effects. Take 2-6 capsules of the supplement L-Glutathione, L-Cysteine, & C daily.
15. Alfalfa sprouts are available as a food product in most health food stores and may be added to salads or blended into a juice. Dried herbs from alfalfa leaves and sprouts may be brewed into a tea--1 oz steeped in 1 pint of water for 20 minutes--2 cups daily. Dried powder capsules may also be taken at a dose of 4-6 capsules a day. Due to its high iron content, alfalfa should not be taken by individuals with toxic or chronic iron overload.
16. Include citrus fruit and foods containing buckwheat flour in your diet as natural sources of rutin. A convenient source of supplemental rutin is 1/4 tsp of Rutin Powder taken 2-3 times daily with a beverage.
17. Consider taking MSM, alpha-lipoic acid, glycine, and chlorella for their natural detoxifying benefits. MSM has anti-inflammatory benefits. A daily dose of one to three 1000-mg capsules is suggested. MSM is most effectively utilized when taken with meals. Alpha-lipoic acid is a universal antioxidant and meets all antioxidant evaluation criteria. For healthy people, take one to two 250-mg capsules daily. Glycine is a chemically simple and abundant conditionally essential amino acid. It combines with many toxic substances and converts them to harmless forms, which are then excreted. One tsp. of glycine powder provides 2.8 grams of pure glycine (1 gram or more may be taken because glycine is nontoxic). Glycine powder is easily soluble in juice or water and is not unpleasant tasting.
 - o **Note:** *Chlorella causes diarrhea in some persons. Start with a small dose (i.e., two 500-mg tablets daily) and consider adding cellulose enzyme.*
18. Include daily dietary fiber from natural sources such as carbohydrates, fruits, vegetables, whole grain products, wheat bran, and beans, when possible. Supplemental fiber from Fiber Food Caps is another good source of natural, soluble fiber. Take 6 capsules with each meal and at least 10 oz of water. If necessary, use smaller doses at first until your digestive system adjusts to the added fiber. If gas or bloating occurs, reduce the dose until tolerance is achieved.
19. On an empty stomach, take one to four 200-mg capsules of SAME daily with water. Take folic acid, B12, and B6 when taking SAME.
 - o SAME should not be taken with antidepressants except under a physician's care.
20. Consider silibinin and silymarin for their liver protective benefits. A suggested dose of Silibinin Plus is one 326-mg capsule taken 2 times daily. An alternative is one 100-mg capsule of Silymarin taken 4 times daily. Silymarin contains milk thistle standardized at 80%.

For more information

American Board of Chelation Therapy, (312) 266-7246; [American College of Advancement in Medicine](#), American College of Nutrition, (727) 446-6086; American Association of Naturopathic Physicians, (877)969-2267; National Institutes of Health, (301) 496-4000; Food and Drug Administration, (888) 463-6332; Agency for Toxic Substances and Disease Registry, (888) 422-8737.

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