



WellnessOne Newsletter

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The Mineral That Helps Fight Fatigue, Stress, Pain, Cancer, and Wrinkles, Too

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By Dr. Mercola

Sulfur is the third most abundant mineral in your body, after calcium and phosphorous. It's an important mineral element that you get almost wholly through dietary proteins, yet it's been over 20 years since the U.S. Food and Nutrition Board (FNB) issued its last update on recommended daily allowances (RDA) for it.

In a study examining critical elements about how sulfur works in the body, researchers say the importance of this mineral may be underestimated, and that it's possible that we may not be getting enough of it.



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The Importance of Sulfur

Close to half of the sulfur in your body can be found in your muscles, skin and bones, but it does much more than benefit just these three areas. It plays important roles in many bodily systems.

Sulfur bonds are required for proteins to maintain their shape, and these bonds determine the biological activity of the proteins. For example, as explained in the featured MSM newsletter, hair and nails consist of a tough protein called keratin, which is high in sulfur, whereas connective tissue and cartilage contain proteins with flexible sulfur bonds, giving the structure its flexibility. With age, the flexible tissues in your body tend to lose their elasticity, leading to sagging and wrinkling of skin, stiff muscles and painful joints.

A shortage of sulfur likely contributes to these age-related problems.

In addition to bonding proteins, sulfur is also required for the proper structure and biological activity of enzymes. If you don't have sufficient amounts of sulfur in your body the enzymes cannot function properly, which can cascade into a number of health problems as without biologically active enzymes, your metabolic processes cannot function properly.

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Sulfur also plays an important role in:

- Your body's electron transport system, as part of iron/sulfur proteins in mitochondria, the energy factories of your cells
- Vitamin-B thiamine (B1) and biotin conversion, which in turn are essential for converting carbohydrates into energy
- Synthesizing important metabolic intermediates, such as glutathione
- Proper insulin function. The insulin molecule consists of two amino acid chains connected to each other by sulfur bridges, without which the insulin cannot perform its biological activity
- Detoxification

[The featured study](#) looked at a broad scope of overlapping metabolic pathways in order to determine which ones may be affected by insufficient intake of dietary sulfur. They also evaluated the modes of action of a variety of sulfur-containing dietary supplements, including chondroitin and glucosamine, commonly used to improve joint health.



According to the authors:

"Sulfur amino acids contribute substantially to the maintenance and integrity of the cellular systems by influencing cellular redox state and the capacity to detoxify toxic compounds, free radicals and reactive oxygen species.

... Sulfur containing metabolites, of which glutathione is a key exponent, merge in their functioning with many other compounds that play a major role in mechanisms which are receiving tremendous interests as parts of conventional and complementary medical care. These include the n-3 and n-6 polyunsaturated fatty acids, minerals such as Selenium, Zinc, Copper and Magnesium, vitamins E and C, antioxidants such as the proanthocyanidins and lipoic acid, many of which are involved in the synthesis of prostaglandins and in the antioxidant cascade.

More and more evidence is accumulating and focusing on the cooperative role that glutathione and other sulfur metabolites play in the homeostatic control of these fundamental mechanisms."

Are You Getting Enough Sulfur in Your Diet?

As stated in the [featured research](#), only two of the 20 amino acids normally present in foods contain sulfur:

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1. Methionine, which cannot be synthesized by your body and must be supplied through diet, and
2. Cysteine, which is synthesized by your body but requires a steady supply of dietary sulfur in order to do so

Neither of these are stored in your body. Rather, "any dietary excess is readily oxidized to sulphate, excreted in the urine (or reabsorbed depending on dietary levels) or stored in the form of glutathione (GSH)," according to the researchers. (Glutathione is comprised of three amino acids: cysteine, glutamate, and glycine, and is [your body's most potent antioxidant](#), which also keeps *all other* antioxidants performing at peak levels.)

Furthermore:

"The availability of cysteine appears to be the rate limiting factor for synthesis of glutathione (GSH).

GSH values are subnormal in a large number of wasting diseases and following certain medications leading frequently to poor survival. By supplying sulfur amino acids (SAA) many of these changes can be reversed.

In the brain, which is usually the most spared organ during nutrient deficiencies, GSH concentration declines in order to maintain adequate levels of cysteine. This loss of GSH impairs antioxidant defences... Cartilage, less essential for survival, may not fare well under conditions of sulfur deprivation, explaining why dietary supplements containing sulfur (chondroitin sulfate, glucosamine sulfate, MSM (Methylsulfonylmethane), etc.) may be of benefit in the treatment of joint diseases."

In conclusion, they state that:

"Out of this study came information that suggested that a significant proportion of the population that included disproportionately the aged, may not be receiving sufficient sulfur and that these dietary supplements, were very likely exhibiting their pharmacological actions by supplying inorganic sulfur."

Dietary Sources of Sulfur

The best and most ideal way to obtain sulfur is through your diet. Sulfur is derived almost exclusively from dietary protein, such as fish and high-quality (organic and/or grass-fed/pastured) beef and poultry. Meat and fish are considered "complete" as they contain all the sulfur-containing amino acids you need to produce new protein. Needless to say, those who abstain from animal protein are placing themselves at far greater risk of sulfur deficiency.

Other dietary sources that contain small amounts of sulfur include:

Organic pastured eggs	Legumes	Garlic	Onion
Brussel sprouts	Asparagus	Kale	Wheat germ

MSM, an Organic Form of Sulfur

Methylsulfonylmethane, commonly known by its acronym, MSM, is not a drug. It's an organic form of sulfur and a potent antioxidant, naturally found in many plants. While MSM is an important source of organic sulfur, it also has other unique properties. Common health complaints associated with low concentrations of MSM in your body include:

- Fatigue
- Depression
- High sensitivity to physical and psychological stress
- Degenerative diseases

MSM's ability to neutralize inflammation is one of the greatest, and one of the most inexpensive, discoveries in the health field, and is thought to be particularly beneficial in the prevention of heart disease. It has been shown to break down the plaque in your arteries, which is associated with chronic inflammation.



Other [health benefits associated with MSM](#) include:

Reducing chronic pain	Improving cellular uptake of many nutrients including vitamins A, B, C, D, E, amino acids, selenium, calcium, magnesium, coenzyme Q10	Preventing cancer	Reducing or eliminating muscle soreness and cramps
Detoxification	Alleviating symptoms of allergies	Anti-parasitic action against Giardia, Trichomonas, roundworms, nematodes, Enterobius and other intestinal worms	Improving lung function by allowing your body to more effectively take up oxygen

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Preventing neurological disease by repairing oxidative damage and restoring cell membrane elasticity and permeability

Preventing and reducing symptoms of autoimmune diseases by fighting chronic inflammation

Preventing diabetes by promoting healthy insulin function

Increasing strength and endurance, and reducing stress

Sources of MSM, and Dosages

MSM can be found in:

- Raw grass-fed milk
- Fresh vegetables, and
- Fruits

The amounts of sulfur you can obtain from these sources range between one to five mg/kg. Raw pastured milk contains the highest amounts of MSM: between two to five mg/kg. However, it's important to know that MSM is rapidly lost during heating, so pasteurized milk is *not* a good source. It contains less than 0.25 mg/kg MSM... Ditto for thoroughly cooked vegetables, and fruits and vegetables kept for a period of time. Hence, you'll want to consume most of your veggies raw as soon as possible after harvesting. If you eat a diet consisting primarily of processed and thoroughly cooked foods, you can be virtually guaranteed that you're not getting sufficient amounts of sulfur in your diet.

MSM is also highly concentrated in aloe vera, so you can use natural aloe vera products to increase your intake of MSM in its natural form.

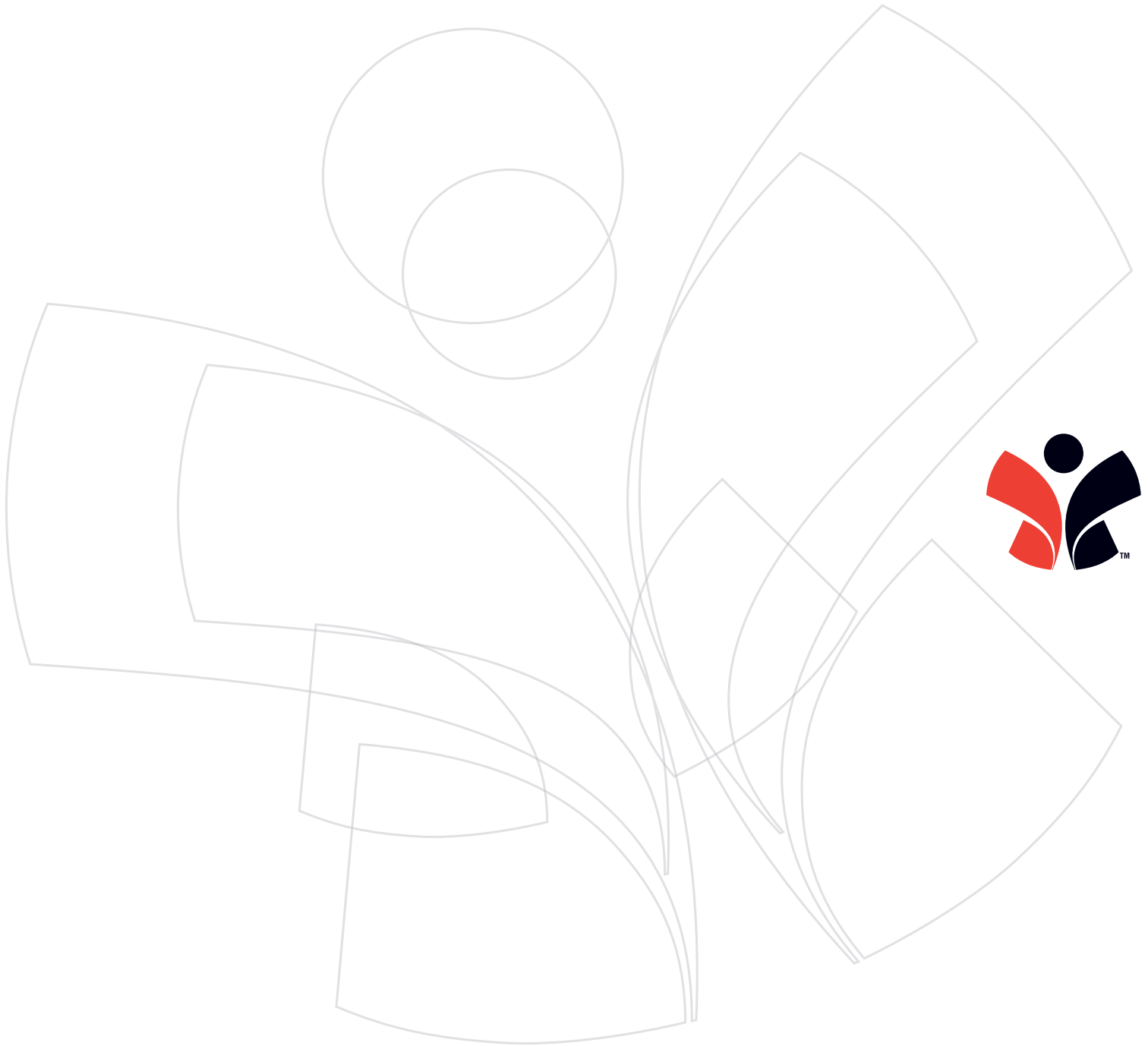
Another alternative is to take MSM as a dietary supplement. In a previous [interview](#), [superfood expert David Wolfe](#) recommended taking about 2,500 mg per day to start; slowly working your way up to about 5,000 to 7,500 mg per day. Keep in mind that there may be side effects because MSM can detoxify you, and that may initially aggravate any condition you have. So increase dosage slowly to allow your body to adjust. Avoid increasing the dose until all detox symptoms have disappeared. Also, avoid taking it at night, as it may increase your energy levels.

As with most supplements, quality is a concern when it comes to MSM as well. *It's important to note that if you're allergic to sulfa drugs, you may also have trouble with MSM.*



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Aside from that, MSM is extremely non-toxic. So far no one has found an upper limit at which point it causes toxic effects. This fact makes it an ideal form of sulfur supplementation, as the sulfur-containing amino acids methionine and cysteine can both cause toxic symptoms at large doses.



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