THE IMPORTANCE OF TRACE MINERALS

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Although most people know minerals are important to their health, few people know exactly why or even that much about them. Biochemically speaking. minerals are inorganic chemical elements not attached to a carbon atom. There is a distinction between minerals and trace minerals (also called -trace elements) If the body requires more than 100 milligrams (i.e., more than 1150th of a teaspoon) of 11 mineral each day. the substance is labeled a mineral. If the body requires less than this, it is labeled a trace mineral. Trace minerals are generally needed in quantities of only a few milligrams (mg) or micrograms (mcg) per day. For a list of the essential minerals and trace minerals as well as nonessential contaminants. please see Table 1 on NSN page 12.

When studying the relationship of minerals to human health, it becomes increasingly evident that keeping a balance level of minerals in every organ, tissue and cell of the human body may be a prominent key to maintaining a healthy existence. As early as 1964, two mineral researchers wrote; "Even small departures from the normal mineral composition of the milieu interior [the interior of the cell may have profound physiological consequences..." Although minerals comprise only a fraction of total body weight, they are crucial for many body functions including transporting oxygen, normalizing the nervous system and simulating growth, maintenance and repair of tissues and bones.

One can summarize the health benefits of some of the more important minerals and trace minerals as follow. As stated below, these minerals and trace minerals can be of most benefit if they are in balance with other elements they interact with.

*** Calcium: Essential for developing and maintaining healthy bones** and **teeth** Assists in blood clotting. muscle contraction, nerve transmission, oxygen transport. cellular secretion of fluids and enzyme activity Optimal intake helps reduce risk of osteoporosis.

*** Chromium: Aids in glucose metabolism** and helps regulate blood sugar by potentiating insulin and serving as a component of glucose tolerance factor.

*** Colbalt:** Promotes the formulation of red blood cells and and serves as a component of the vitamin B-12.

***** Copper: Essential to normal red blood cell formation and connective tissue formation. Acts as a catalyst to store and release iron to help form hemoglobin. Contributes to central nervous system function.

*** Iodine: Needed by the thyroid hormone to support** metabolism.

*** Iron: Necessary for red blood cell formation and function** Required for transport of oxygen throughout the body> Important for brain function. Amount needed is higher in women of childbearing age.

*** Magnesium: Activates over 100 enzymes and helps** nerves and muscles function. Helps maintain the integrity of cell membranes and stabilizes the cell electrically Critical for proper heart function.

*** Manganese: Key component of enzyme systems,** including oxygen-handling enzymes Supports brain function and reproduction Required for blood sugar regulation Part of bone structure.

*** Molybdenum: Contributes to normal growth and development Key component in many enzyme systems** including enzymes involved in detoxification.

*** Phosphorous: Works with calcium to develop and** maintain strong bones and teeth. Enhances use of other nutrients Key **role** in cell **membrane integrity and intercellular** communication Critical for proper energy processing in the body

*** Potassium: Regulates heartbeat, maintains fluid** balance and helps muscles contract.

***** Selenium: Essential component of a key antioxidant enzyme, necessary for normal growth and development Role in detoxification of heavy metals. such as mercury. Role in production of antibodies by the immune system. Component of teeth.

***** Sulfur: Needed for structure of most protein, including **muscles and hair. Critical role in liver detoxification. Important functions in antioxidant nutrients and oxygen** handling Role in growth.

*** Zinc: Essential part of more than 200 enzymes** involved in digestion, metabolism, reproduction and wound **healing Critical role in immune response Important** antioxidant

There are even more benefits than these, so it is certainly easy to see that minerals play an important role in health.

Mineral Absorption

Every person absorbs minerals in a slightly different way --- a process called biochemical individuality. According to Ruth L. Pike and Myrtle L. Brown in their book Nutrition: ***Integrated Approach.*** "Whatever the nutritional potential of a food, its contribution is nonexistent if it does not pass the test of absorption. Those nutrients that have not been transferred through the intestinal mucosal cell to enter the circulation have. for all nutritional intent and purpose, never been eaten. The variety of nutrients from the organism's environment that have been made available by absorption must be transported through the circulatory system to the aqueous microenvironment of the cells Then. they serve their ultimate purpose -- participation in the metabolic activities in the cells on which the life of the total organism depends."'

The absorption of minerals is dependent on many different factors. not the least of which is age as well as adequacy of stomach acid output, balance of bowel flora, presence or lack of intestinal illness"- and parasites, and amount of dietary fiber intake.

Aging increases the risk of gastric atrophy, a condition that commonly is associated with a decreased secretion of hydrochloric acid in the stomach. The problem becomes that as a level of hydrochloric acid output decreases the body's ability to absorb minerals from the food-bound form diminishes. This inability to adequately absorb minerals contributes to age-associated degeneration. Hence, the form a mineral takes is crucial. since the less dependent It is on hydrochloric acid to be absorbed, the more likely it will be able to be utilized by the body.

Gastric atrophy or conditions such as achlorhydria (lack of stomach acid) or hypochlorhydria (inadequate stomach acid) can also impair the body's absorption of important minerals. Achlorhydria has been found in children as young as five or six years of age. Hypochlorhydria, however, is more commanly seen after age 35. It is estimated that between 15-35 percent of adults over age 60 have some degree of gastric atrophy, including hypochlorhydria.'

Some acid-dependent minerals that require adequate stomach acid to enhance intraluminal absorption (the transfer of nutrients to the circulatory system) in the small intestine include the following.

* chromium
* manganese
* copper
* molybdenum
* iron
* selenium
* magnesium and
* zinc

Nonessential Mineral Contaminants

The absorption and efficient use of mineral in the body can also be affected by excessive levels of nonessential mineral contaminants such as aluminum, arsenic, cadmium, lead and mercury. These toxic minerals can have an "unbalancing" effect on the body's cells (see Table 2).

Cadmium, for example, an air pollutant from cigarette smoke and industrial emissions and a by-product of population growth, is experimentally known to cause hypertension, cancer and immune disorders. Cadmium acts like a classical stress agent. It has also been implicated in learning disabilities. Unlike lead, which has a short half-life in human tissue of from 30 to 100 days, cadmium has a half-life of between 10-30 years.

While it is known that free cadmium is very toxic, it has also been found to greatly increase the toxicity of other agents. Cadmium has a unique capacity to form a close bond with chloride compounds such as the chlorinated pesticide lindane. When the two are combined, they alter liver metabolism and tissue levels of lindane double.

Cadmium accumulates in cells that are the most malignant; in prostate cancer, for example. there is a linear correlation between the grade of malignancy and cadmium content. On the positive side, little cadmium is absorbed orally unless there are nutrient deficiencies.

Recent research indicates that adequate dietary intake of essential minerals and trace minerals may prevent and reduce affects of poisoning by environmental pollutants and enhance the ability to work and learn. They can protect the body from the effects of toxic minerals(4). Minerals that protect against cadmium and other nonessential mineral contaminants are listed in Table 2.

Besides optimum levels and kinds of minerals to cope with toxicity, mineral requirements are affected by two other factors -- disease and drug-nutrient interaction Physical illness can raise demands for many trace elements. for example, the need for magnesium increases in heart disease and eating disorders. And the demand for some minerals, such as zinc, increases under psychological, stress. Drug-nutrient interaction can also create deficiencies and imbalances of minerals at the cellular level For example, the absorption of iron from the gut can be reduced by antacids and tetracycline. Magnesium and zinc are hyper-excreted by those receiving oral diuretics, nephrotoxic drugs, penicillamine, or antacids containing aluminum hydroxide

Optimal Mineral Levels

Considering the importance of minerals to good health, establishing optimal mineral levels -- i.e. an update on the Recommended Dietary Allowances (RDAs), released in their 10th edition in 1989 -- is an urgent need.

Recent analyses of data of nutrient and supplement intake in the United States conducted by the U.S. National Institutes of Health and other government agencies indicate that the vast majority of people in both affluent and emerging industrialized countries do not reach even 75 percent of the RDAs for numerous trace minerals.

It is valuable to remember, however. that the realization of importance of trace minerals to human health is a recent discovery For example. only fifteen years ago, every textbook taught that the trace element boron was nonessential to all mammals, including man However, today, it is believed to be so important to human health that numerous scientists are preparing to petition the government to recognize boron as a trace mineral essential to human health

Minerals and trace minerals do not exist by themselves but in relationships to one another Too much of one element can lead to imbalances in others, resulting in disease rather than the absence of disease. Factors such as diet, absorption ability, toxicities and drug-nutrient interactions play a role in maintaining a balance of trace elements in the body. NSN

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Table 1 *Minerals, Trace Minerals And Mineral Contaminants*

Essential Minerals:	Essential Trace Minerals:	Nonessential Contaminant Minerals:
Calcium	Chromium+	Aluminum
Chloride*	Copper+	Arsenic (in abundance)
Magnesium	Cobalt	Barium
Phosphorus	Fluorine+	Beryllium
Potassium*	Iodine	Cadmium
Sodium*	Iron	Lead
Sulfur*	Manganese+	Lithium
	Molybdenum+	Mercury
	Selenium	Rubidium
	Vanadium+	Strontium
	Zinc	

• No RDAs set for these minerals Only estimated requirements are established for chloride, potassium and sodium No estimates as yet established for sulfur.

+ No RDAs as yet established for these minerals Estimated safe and adequate intakes are established for chromium, copper, chlorine, manganese and molybdenum There is no estimate as yet established for vanadium

NOTE: Several trace minerals that may be essential but have not yet been proven to be include minute amounts of arsenic, boron, nickel, silicon and tin.

Table 2 *Mineral Contaminants Guide*

Mineral Contaminate	Body Part Affected	Protective Nutrients
Aluminum	Stomach, bones, brain	Possibly magnesium None other known
Arsenic	Cells (cellular metabolism)	Selenium, Iodine, calcium, zinc, vitamin C, sulfur amino acids
Cadmium	Renal cortex of the kidney, heart, blood vessels to the brain appetite and smell center of the brain, every known process in the development of cancer	Zinc, calcium, vitamin C, sulfur ammo acids
Lead	Bones, liver, kidney, pancreas, heart, brain, nervous system	Zinc, iron, calcium, vitamin C, vitamin E, sulfur amino acids
Mercury	Nervous system, appetite and pain centers of the brain, immune system, cell membranes	Selenium, vitamin C. pectin, sulfur amino acids