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Minerals are inorganic substances mined from the earth, meaning they are not of plant or animal origin. They exist naturally on and in the earth and many are critical parts of human tissue and are termed “essential” nutrients. Of the 92 naturally occurring elements, the 14 minerals that have been shown by research to be essential to human health are: *calcium, chromium, copper, fluorine, iodine, iron, magnesium, manganese, molybdenum, phosphorus, potassium, selenium, sodium and zinc*.<sup>\*1</sup> Essential *macrominerals* are those we need in significant quantities (such as calcium) – usually measured in milligrams, and essential *trace minerals* are those we need in minute quantities (such as selenium) – usually measured in micrograms (one microgram [mcg] equals 1/1,000th of a milligram [mg]).

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These 14 essential minerals are crucial to the growth and production of bones, teeth, hair, blood, nerves, skin, vitamins, enzymes and hormones; and the healthy functioning of nerve transmission, blood circulation, fluid regulation, cellular integrity, energy production and muscle contraction.\*

Minerals work in combination with each other and with other nutrients, so imbalances of any mineral can cause health problems – too little of any essential mineral can lead to deficiency diseases, and too much of any mineral can be toxic.<sup>2</sup>

We get these essential minerals primarily through the foods we eat. Good sources of essential minerals include fruits, vegetables, meats, nuts, beans and dairy products. Unfortunately, much of the soil in which food is grown has been depleted of these nutritive minerals, therefore the mineral content in food is reduced.<sup>3,4</sup> We also obtain some minerals from the water we drink, but the amounts vary widely.

Mineral availability and absorption is also affected as foods are cooked, processed and refined, and many naturally occurring minerals in food are removed.<sup>5, 6</sup> A daily mineral supplement is not a substitute for a healthy diet, but can ensure we get the minerals we need for optimal health.

## MACRO MINERALS

### CALCIUM

Calcium is the most important, and most common, mineral we need. Eating a diet rich in nutrients that help your bones stay strong should be the first step in stopping or slowing the process of osteoporosis. Calcium, magnesium, vitamin D, phosphorus, soy-based foods and fluoride compose the major nutrients that strengthen bone. At this moment, 98 percent of your body's calcium resides in your bones, the rest circulates in the blood, taking part in metabolic functions. Because the body cannot manufacture calcium, you must eat calcium in your daily diet to replace the amounts that are constantly lost. When the diet lacks sufficient calcium to replace the amount that is excreted, the body begins to break down bone for the calcium necessary for life-preserving metabolic processes. Calcium in the diet can generally slow calcium loss from bones, but it usually doesn't seem to replace calcium already gone. The National Institutes of Health recommend 1000-1200 milligrams of dietary calcium per day for premenopausal women and 1200-1500 milligrams for menopausal and postmenopausal women. Good sources of calcium include milk and milk products, yogurt, ricotta, cheese, oysters, salmon, collard greens, spinach, ice cream, cottage cheese, kale, broccoli and oranges. If you cannot tolerate dairy products, calcium supplements are an easy way to consume calcium. Take supplements with a meal to aid absorption of calcium from the stomach.

## IRON

Iron carries oxygen to the cells and is necessary for the production of energy, the synthesis of collagen, and the functioning of the immune system.\* Iron deficiency is common only among children and pre-menopausal women. Great care must be taken not to take too much iron, as excess amounts are stored in the body's tissues and adversely affect the body's immune function, cell growth and heart health.\*7, 8, 9 A blood test is the most effective way to determine needs, and consultation with a trained health professional is strongly recommended. Iron absorption can be blocked by calcium, magnesium, manganese, zinc, antacids and tetracycline (a common antibiotic).<sup>2</sup> Iron is found in meat, fish, beans, spinach, molasses, kelp, brewer's yeast, broccoli and seeds. Because iron from plant sources is not as well absorbed as that from animal sources, some experts recommend that vegetarians supplement with, or eat foods high in, vitamin C as it enhances iron absorption.<sup>10</sup>

## MAGNESIUM

Magnesium is essential to maintain both the acid-alkaline balance in the body and healthy functioning of nerves and muscles (including the heart), as well as to activate enzymes to metabolize blood sugars, proteins and carbohydrates.\*<sup>2</sup> Magnesium is vital for proper bone growth and is indirectly related to adequate calcium absorption.\*<sup>11</sup> A 2:1 ratio of calcium to magnesium is essential to maintain strong bones. Indications of a magnesium deficiency may be muscle twitches, nervousness, abnormal heart beat and disorientation. <sup>2</sup> Good food sources of magnesium include seeds, unrefined grains, beans and other vegetables.

## PHOSPHORUS

Most phosphorus in the body is found in bone, usually at a 1:2 ratio to calcium. In soft tissue and cells, phosphorus contributes to many natural chemical body processes.<sup>11</sup> For example, phosphate bonds of ATP (adenosine triphosphate) provide the energy necessary for metabolism.<sup>11</sup> Food sources of phosphorus include protein-rich foods such as meats and dairy products, although some is present in almost all foods. Due to the abundance available in the average diet, as well as its high absorption rate, most supplements do not contain phosphorus. People taking aluminum hydroxide as an antacid for extended periods of time may develop a phosphorus deficiency since the aluminum prevents phosphorus absorption.<sup>11</sup>

## ZINC

Zinc supports the health of the immune system, normal synthesis of protein, and the health of reproductive organs (especially in men).\*<sup>2</sup> Zinc deficiency is common, and can adversely affect normal physical growth, skin and nerve health, natural healing ability, and immune function, especially in infants.\*<sup>12</sup> Smoking and excessive alcohol consumption adversely affect zinc levels.<sup>13</sup> Meats, fish, beans, whole grains, pumpkin seeds, mushrooms and brewer's yeast are good food sources of zinc.

Too much zinc can lower copper retention, lower HDL ("good") cholesterol,<sup>14</sup> and impair immune function at dosages of 100 mg/day or more.\*<sup>15,16</sup> Adverse effects may occur if the balance of zinc to other minerals is not maintained.\*<sup>2</sup>



### Product Recommendations



Promotes muscle relaxation.

Adequate magnesium must be available to relax muscles and relieve cramping, stiffness and soreness.

Magnesium is also especially important as a co-factor for the use of energy in the heart

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## TRACE MINERALS

## CHROMIUM

Chromium functions as part of several enzyme systems, including the glucose tolerance factor (GTF), which works with

insulin in the utilization of glucose (blood sugar).<sup>\*</sup> Insulin helps to control metabolism of triglycerides (the main form of fat in the body), therefore chromium has a positive effect on triglycerides due to its influence over insulin.<sup>\*</sup> Chromium deficiency has been linked to improper metabolism and imbalances of blood sugar.<sup>\*</sup> 18, 19 While popularly used as a supplement to achieve weight loss and muscle gain, research is not consistent enough to validate chromium's effect for those benefits.<sup>\*</sup>20, 21

According to the U.S. Department of Agriculture widespread chromium deficiency is due not only to inadequate food intake but also to excess sugar intake that increases chromium losses in the body.<sup>\*</sup>22 The only common food source is brewer's yeast. Chromium should not be taken in excess however—there have been reported cases of toxicity when used in high doses (>800 mcg/day).1, 23



## COPPER

Blood, nerves, joints, heart, skin, liver and both the immune and nervous systems all need adequate amounts of copper, most of which is concentrated in the brain and liver.<sup>\*</sup> Copper is critical to the absorption and utilization of both zinc and iron.<sup>\*</sup>24, 25 A deficiency of copper has been linked to an inability to produce the important antioxidant enzyme, superoxide dismutase (SOD), and to a shortage of red blood cells.<sup>\*</sup>24, 25 It is especially important to balance copper levels with those of zinc because an excess of either will depress retention and utilization of the other.<sup>\*</sup> 26 Readily available through the diet, copper is commonly found in whole grains, nuts, shellfish, liver and dark green, leafy vegetables.



## IODINE

Elemental iodine is essential to the development and functioning of the thyroid gland, and a deficiency can cause an enlargement of the gland.<sup>\*</sup>27 Deficiency of iodine during pregnancy and infancy may lead to abnormalities in brain development and in children's growth.<sup>\*</sup>28 Iodized salt is the most common source of this essential trace mineral. Those with thyroid abnormalities should consult a health care practitioner before taking more than 150 mcg of iodine per day. For most people, amounts up to 1,000 mcg per day are safe, although some may be sensitive to it (resulting in skin irritations or difficulty breathing).



## MANGANESE

The essential trace mineral manganese is necessary for normal bone metabolism and important enzyme reactions<sup>\*</sup>28 It also helps maintain normal nerve, brain and thyroid function.<sup>2</sup> While a deficiency of this mineral is uncommon, it is often lost in processed foods.<sup>29, 30</sup> A deficiency of manganese may affect brain health, glucose tolerance, normal reproduction, and skeletal and cartilage formation.<sup>\*</sup>31 Grains and cereal products are the best food sources of manganese, while animal products are the poorest. Toxicity from manganese is uncommon.<sup>11</sup>



## MOLYBDENUM

Molybdenum is involved in the operation of several key enzymes in the body. Readily available throughout the diet, deficiencies of this essential mineral are unusual, although rare deficiencies occur in people who suffer from malabsorption conditions.<sup>\*</sup>32. Milk, beans, cereals and bread are common food sources of molybdenum. Elevated levels of molybdenum can cause a loss of copper.<sup>\*</sup> 11



## SELENIUM

This powerful antioxidant works closely with vitamin E and supports critical antioxidant enzyme functions.<sup>\*</sup>2 As an antioxidant, selenium may reduce the risk of abnormal cell growth,<sup>\*</sup>33 while supporting cardiovascular health.<sup>\*</sup>34 Seafood and organ meats such as liver and kidney are high in selenium, whereas selenium levels in grains and vegetables vary widely, depending on local soil content.<sup>35</sup> No more than 200 mcg of selenium daily is recommended for general use, because of possible toxicity. Excessive intakes of selenium can affect the functioning of enzymes and normal bone and cartilage development in fetuses, according to animal studies. In milligram amounts (75 mg/day), selenium can cause nausea, loss of hair and nails, skin abnormalities and nerve damage.<sup>1</sup>

## NON-ESSENTIAL TRACE MINERALS

Other trace minerals that have not yet been recognized by health authorities as essential to human nutrition, but have some valid health benefits are arsenic, boron, nickel, silicon and vanadium.\*17

**Boron** — Valid clinical studies show that it is involved in the metabolism of other minerals, especially calcium and magnesium, that support bone health.\*36 It may also be involved in the regulation and function of steroid hormones.\*37 Readily available in prunes, soy, raisins, beans and nuts, boron's benefits to human health are recent discoveries, just since the mid-1980s. Microgram amounts are not considered toxic.

**Silicon** — Silicon is important in the composition and calcification of cartilage to produce bone, and is common in unrefined foods of plant origin.\*2

**Vanadium** — There is some scientific evidence that vanadium contributes to fat metabolism.\*2, 38 Vanadium in microgram dosages has low potential for toxicity.\*39

## ELECTROLYTES

Electrolytes are the elements necessary for electrochemical activity in our body. Water (H<sub>2</sub>O) – and the three minerals sodium, potassium and chloride are all necessary for the transmission of electrical impulses between cells. Sodium and potassium are *cations* (positively charged atoms), and chloride is an *anion* (negatively charged atom) – all are essential nutrients. These minerals are supplied by the typical diet in thousands of milligrams per day. Sodium and chloride are overabundant in the diet and are not generally added as a mineral supplement.

### POTASSIUM

**Potassium** is the major mineral in, and primary regulator of, fluids inside cells – along with sodium.\*11 Potassium is critical to the transmission of nerve impulses, muscle contractions and maintenance of normal blood pressure.\*11 The kidneys control potassium levels, if adequate water is consumed.\*2 Potassium deficiency is rare in healthy people – but is a very common side effect of two widely abused modern drugs – chemical laxatives and diuretics. Potassium deficiency can also be caused by excessive vomiting, chronic diarrhea or kidney failure. Signs of deficiency may include muscle weakness, intestinal problems, heart abnormalities and respiratory weakness.\*2

Potassium is widely available in foods, but mostly in unprocessed fresh foods – especially fruits and vegetables. The estimated average adult intake of potassium varies widely between 1,000 and 10,000 mg daily, depending on diet (vegetarians get the most).<sup>40,41,42,43,44</sup> Potassium is toxic for healthy adults if daily intakes exceed 18,000 mg.<sup>45</sup> Pills with more than 100 mg, if taken on an empty stomach and without sufficient water, may cause ulcerations in the stomach or esophagus.



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