

REBUILD
your
BONES

NATURE'S 40 MOST
POWERFUL
MICRONUTRIENTS
FOR OSTEOPOROSIS

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and JAYSON CALTON, PHD

Nature's 40 Most Powerful Micronutrients for Osteoporosis.

From your essential vitamins and minerals, to the less talked about fatty acids and amino acids, consider this your guide to 40 health promoting micronutrients you need every day. For each micronutrient, we'll show you why you need it and the possible health consequences for those who don't get the minimum Reference Daily Intake (RDI). Next, you'll learn how each micronutrient can help you rebuild your bones and beat osteoporosis. Then, you'll discover how to identify the beneficial forms and quantities you should be looking for when purchasing a well-formulated supplement. Last, we reveal a list of the best food sources for each micronutrient and even give you helpful information on cooking and storage methods that can help you preserve micronutrient potency.

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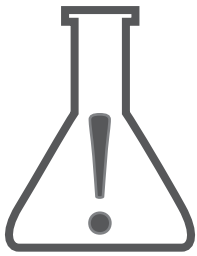
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VITAMINS

VITAMIN A

:: Retinoid + Beta-Carotene

RDI : 3000 IU



Signs of Vitamin A Deficiency

- △ Frequent viral infections or colds
- △ Night blindness (nyctalopia)
- △ Dry eyes (xerophthalmia)
- △ Irritability, stress, and depression
- △ Hypothyroidism
- △ Goose bump-like appearance of the skin (hyperkeratosis)
- △ Bone deformities or poor growth in children

Why You Need It

The primary function of this fat-soluble vitamin is to preserve eyesight. **Vitamin A** is also essential for the formation and development of bone, teeth, and connective tissue. It also maintains the integrity of the skin and the linings of your urinary tract, lungs, and digestive system. It is required for DNA translation and both male and female reproductive processes. **Vitamin A** also helps fight viral infections and is thought to help fight cancer as well.

How It Fights Osteoporosis

This powerful antioxidant protects against oxygen-based damage to cells (free radicals, inflammation). It also plays an essential role in regulating osteoclast function and development of osteoblasts. A deficiency in **vitamin A** also limits *calcium* absorption and metabolism. Both low and excessively high serum **vitamin A** concentrations are associated with an increased risk of hip fracture.

How To Identify Beneficial Forms & Quantities

Some multivitamins contain only beta-carotene, an inactive form of **vitamin A** (provitamin A), which must be converted in the body to retinyl (preformed), an active form (conversion rate of 21:1). Because of the poor conversion rate of beta-carotene, a supplement should be formulated to include at least 2,500 IU of preformed **vitamin A** in the natural form, **retinyl acetate** (preferred), or in the synthetic form, **retinyl palmitate**.

Where You Get It

Vitamin A

- ☯ Liver
- ☯ Kidney
- ☯ Cod liver oil
- ☯ Butter
- ☯ Whole milk, whole cream
- ☯ Egg yolk
- ☯ Shrimp

Beta-Carotene

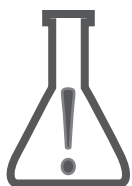
- ☯ Sweet potatoes
- ☯ Carrots
- ☯ Winter squash
- ☯ Dark leafy greens
- ☯ Romaine lettuce
- ☯ Bok choy

How It Can Lose Its Potency

Light and air exposure can partially deplete the **vitamin A** content in our foods; however, **vitamin A** is relatively stable when exposed to heat and is not significantly affected by cooking. In fact, chopping, pureeing, and cooking carotenoid-containing vegetables can make the carotenoids (such as beta-carotene) more available for the body to use.

LUTEIN

RDI : None established.



Signs of Lutein Deficiency

There are no signs to indicate a lutein deficiency.

Why You Need It

Lutein is a carotenoid vitamin essential for optimal eye health, but also has roles as an antioxidant and possibly in combating coronary heart disease.

How It Fights Osteoporosis

Although not essential, this powerful antioxidant protects against oxygen-based damage to cells (free radicals, inflammation); studies suggest that **lutein** can be protective in bone health because it activates Nrf2-driven antioxidant gene expression with a *correlation between intake of lutein and higher BMD*.

How To Identify Beneficial Forms & Quantities

Most multivitamins do not contain **lutein** at all, but we recommend 6 mg of **lutein** because this is the amount that is recommended to prevent/reverse age-related macular degeneration, combat oxidative damage, and protect against blue light damage from computers, TVs, and cell phones.

Where You Get It

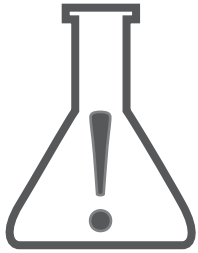
- | | |
|------------|--------------------|
| ☉ Broccoli | ☉ Grapes |
| ☉ Spinach | ☉ Orange Juice |
| ☉ Kale | ☉ Zucchini/Squash |
| ☉ Corn | ☉ Romaine Lettuce |
| ☉ Kiwi | ☉ Brussels sprouts |

How It Can Lose Its Potency

Lutein is depleted by both light and heat. Because it is fat soluble, **lutein** is better absorbed with fat than without.

VITAMIN B₁ :: Thiamine

RDI : 1.2 mg



Signs of Vitamin B₁ Deficiency

- △ Loss of appetite
- △ Sensation of “pins and needles,” numbness in legs, calf muscle soreness
- △ Memory loss in elderly
- △ Insomnia
- △ Edema, increased pulse rate, and palpitations
- △ Eye pain
- △ Constipation
- △ Irritability, depression, and stress

Why You Need It

Thiamine was the first of the B vitamins to be discovered, and it is imperative for energy production. This water-soluble vitamin is necessary for proper functioning of the nervous system and muscles and the conversion of amino acids and fatty acids into proteins, hormones, and enzymes. **Thiamine** can help prevent cataracts. Deficiency can cause depression, irritability, memory loss, cardiovascular disease, and insomnia.

How It Fights Osteoporosis

Vitamin B1 is required for the molecules found in carbohydrates and proteins (in the form of branched-chain amino acids) to be properly used by the body to carry out various bone-building functions. It aids in the normal endocrine function of the pancreas; helps fight stress by maintaining proper function of the adrenal glands. **Thiamine** deficiency reduces stomach acid and calcium absorption, which causes increased chances for osteoporosis.

How To Identify Beneficial Forms & Quantities

Thiamine pyrophosphate is the metabolically active form of **thiamine** and does not require conversion by the body like thiamine HCl and thiamine mononitrate do.

Where You Get It

- ☯ Brewer's yeast
- ☯ Lamb
- ☯ Sunflower seeds
- ☯ Pork
- ☯ Green peas
- ☯ Organ meats
- ☯ Fish (trout, salmon, tuna)
- ☯ Poultry
- ☯ Beans
- ☯ Asparagus
- ☯ Spinach
- ☯ Whole wheat
- ☯ Romaine lettuce
- ☯ Mushrooms
- ☯ Wheat germ
- ☯ Eggs
- ☯ Watermelon
- ☯ Nuts
- ☯ Blackstrap Molasses

How It Can Lose Its Potency

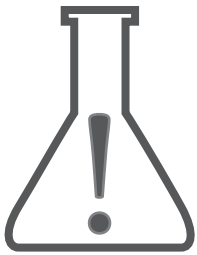
Vitamin B1 is extremely unstable and easily damaged by heat, acid, and chemicals. The processing of grains used for cereals and breads reduces **B1** content by more than half. This is because most of the **vitamin B1** is found in the germ of the grain, which is removed during the milling of the grain. Both sulfites and nitrites, which are often used in food preservation, inactivate **vitamin B1**. Sulfur dioxide used as a preservative in food depletes **B1**.

VITAMIN B₂

:: Riboflavin

RDI : 1.3 mg

Signs of Vitamin B₂ Deficiency



- △ Migraines
- △ Cataracts
- △ Sore throat
- △ Depression, irritability, and stress
- △ Chelosis (characterized by cracks in the corners of the mouth and burning lips, mouth, and tongue)
- △ Red eyes that tear, burn, or itch and are light sensitive
- △ Scaly skin around the nose and genitalia
- △ Dull or oily hair
- △ Split nails
- △ Memory loss in the elderly

Why You Need It

Vitamin B2 is essential for normal growth and development, physical performance, reproduction, lactation, and well-being. It is utilized in essential biochemical reactions, especially energy production. Additionally, it is necessary for the healthy growth of skin, hair, and nails. **Riboflavin** is critical for the metabolism of carbohydrates, fats, and protein. It assists with antioxidant activity and prevents oxygen-based damage. It is part of the enzyme glutathione reductase. Glutathione is a protein-like “antioxidant” molecule that reduces this damage and must constantly be recycled. **Vitamin B2** allows for that recycling to take place. Like all the B vitamins, **B2** is water soluble and must be supplied daily.

How It Fights Osteoporosis

Vitamin B2 plays a role in reducing homocysteine levels (increased homocysteine levels are a risk factor for osteoporotic bone fractures). It assists with antioxidant activity; increased dietary riboflavin has been associated with higher BMD.

How To Identify Beneficial Forms & Quantities

Although many products contain riboflavin HCL, it is inferior to **riboflavin-5-phosphate** because it is not the bioactive form of **vitamin B2**. Riboflavin HCL needs to be converted in the liver to the active form.

Where You Get It

- ☯ Liver
- ☯ Milk
- ☯ Cheese
- ☯ Asparagus
- ☯ Meats
- ☯ Eggs
- ☯ Dark green vegetables
- ☯ Almonds
- ☯ Fish (salmon, tuna)
- ☯ Avocados
- ☯ Mushrooms
- ☯ Wheat germ

How It Can Lose Its Potency

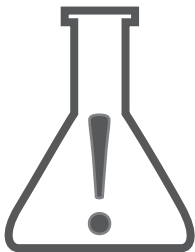
While heat and air have no large damaging effect on **B2**, light is a factor. In fact, **riboflavin**-rich foods should be stored in opaque containers and cooked in covered pots. This includes pasta, which is better purchased in boxes than see-through bags, and milk, which should be stored in light-blocking cartons rather than clear containers. Along with vitamin B1, **B2** is found in the germ of the grain, which is removed during the milling and processing of the grain.

VITAMIN B₃

:: Niacin + Niacinamide

RDI : 16 mg

Signs of Vitamin B₃ Deficiency



- △ Pellagra: A severe deficiency characterized by the four Ds—dermatitis (rough skin), dementia, diarrhea, and death; common in areas where corn is the main food staple
- △ Dry, patchy, scaly skin
- △ Digestive problems, including swollen tongue
- △ Muscular weakness
- △ Mental confusion and delirium in advanced deficiencies
- △ Lack of energy
- △ Insomnia
- △ Migraines
- △ Irritability
- △ Anxiety and stress

Why You Need It

Vitamin B3 can be found naturally in foods or can be synthesized in humans by converting the amino acid tryptophan to niacin (vitamins B1, B6, and iron are necessary for this conversion). It is imperative for energy production, helps lower cholesterol, and protects against DNA damage and cancer. This water-soluble vitamin aids in the regulation of insulin and stabilization of blood sugar. **Vitamin B3** protects against heart attacks, Alzheimer's disease, and cognitive decline. **Niacin** is part of about 200 enzymes, each of which is necessary for chemical reactions in the body to occur, which clearly shows just how important this B vitamin is to your health.

How It Fights Osteoporosis

Vitamin B3 assists in calcium signaling; improves adiponectin secretion, glucose tolerance, and insulin sensitivity; required for conversion of omega-3. There is a positive significant correlation between dietary intake of **vitamin B3** and BMD in premenopausal women.

How To Identify Beneficial Forms & Quantities

Most multivitamins contain only **niacinamide**. However, the two forms of **vitamin B3** perform different functions in your body. **Niacinamide** controls blood sugar, but only **niacin** has been shown to lower LDL (bad cholesterol) and raise HDL (good cholesterol). It is best to include both forms to cover all bases.

Where You Get It

- | | |
|---------------------------------|---------------------|
| ☯ Fish (tuna, salmon, mackerel) | ☯ Yeast |
| ☯ Organ meats | ☯ Peanuts |
| ☯ Poultry | ☯ Legumes |
| ☯ Beef | ☯ Cremini mushrooms |
| ☯ Eggs | ☯ Whole wheat |

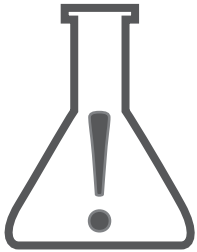
How It Can Lose Its Potency

Heat, air, and light have little damaging effect on **vitamin B3**.

VITAMIN B₅

:: Pantothenic Acid

RDI : 5 mg



Signs of Vitamin B₅ Deficiency

- △ Fatigue
- △ Sensations of weakness
- △ Numbness, tingling, or burning sensations in the feet
- △ Acne
- △ Muscle tremors or spasms
- △ Teeth grinding
- △ Anxiety or tension
- △ Depression

Why You Need It

Once absorbed, **pantothenic acid** is converted into co-enzyme A (CoA), which is the only known biologically active form of **vitamin B₅**. CoA is required for the chemical reactions that generate energy from food (carbohydrates, fats, and proteins) and in the synthesis of essential fats, steroid hormones, cholesterol, the neurotransmitter acetylcholine, and the hormone melatonin. It controls fat metabolism, is essential for the brain and nerves, and helps maintain healthy skin and hair. This water-soluble vitamin helps fight stress by keeping the adrenal glands functioning properly and aids in the detoxification of alcohol.

How It Fights Osteoporosis

Used in the synthesis of coenzyme A (CoA), an enzyme that participates in a variety of reactions in the body, especially the breaking down of fatty acids. A deficiency of **vitamin B₅** can cause an increased sensitivity to insulin. Helps fight off stress (chronic stress is a risk factor for osteoporosis) by maintaining proper function of the adrenal glands and cortisol levels.

How To Identify Beneficial Forms & Quantities

Pantethine (Pantesin ®) is the bioactive form of **B₅**, making it readily used by the body.

Where You Get It

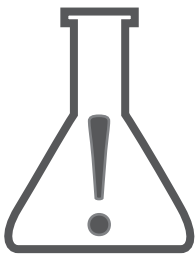
- ☯ Avocados
- ☯ Yogurt
- ☯ Liver
- ☯ Chicken
- ☯ Fish (trout, salmon)
- ☯ Sunflower seeds
- ☯ Shiitake mushrooms
- ☯ Legumes
- ☯ Sweet potatoes
- ☯ Broccoli
- ☯ Eggs

How It Can Lose Its Potency

Cooking, freezing, and commercial processing can significantly deplete **pantothenic acid**. Frozen foods and canned foods and fruit juices all show depletion ranging from 7 to 70%.

VITAMIN B₆ :: Pyridoxal-5-Phosphate

RDI : 1.7 mg



Signs of Vitamin B₆ Deficiency

- △ Depression
- △ Sleep disturbances
- △ Nerve inflammation
- △ Nausea and vomiting
- △ Skin disorders, incl. eczema
- △ Lethargy
- △ Anemia
- △ Elevated homocysteine

Why You Need It

Vitamin B6 is part of more than 100 enzyme reactions. Many of the activities of **vitamin B6** are related to the metabolism of amino acids and other proteins, including hemoglobin, serotonin, hormones, and prostaglandins. This water-soluble vitamin is also essential for brain function and helps balance sex hormones. Moreover, it is a natural diuretic and anti-depressant and may decrease the risk of colon cancer. It promotes the breakdown of sugar and starches. It is key to heart health because **vitamin B6** works alongside vitamin B9 (folate) and vitamin B12 to keep blood levels of homocysteine, an amino acid, within normal

range. It supports your nervous system. The production of neurotransmitters, which foster communication between nerve cells, is made possible by a compound that contains **vitamin B6**. It reduces inflammation that can cause type 2 diabetes, cardiovascular disease, and obesity. Those individuals with inflammation need more **vitamin B6**.

How It Fights Osteoporosis

This vitamin plays a role in reducing homocysteine levels (increased homocysteine levels are a risk factor for osteoporotic bone fractures). It is essential for the enzymatic action of lysyl oxidase in collagen cross-linking formation and bone strength. **B6** deficiency causes an imbalance in the coupling between osteoblasts and osteoclasts with increased bone cavities and reduced new bone formation. It is necessary for hydrochloric acid (HCl) production by the stomach, which in turn is necessary for calcium absorption; **B6** may act as a regulator of the steroid hormones, including estrogen; **Vitamin B6** prevents progesterone deficiency; required for mineral balance; equips you to better deal with stress by aiding in the formation of chemicals called neurotransmitters. Increased dietary **B6** intake was associated with higher BMD.

How To Identify Beneficial Forms & Quantities

Pyridoxal-5-phosphate is the bioactive form of **B6**. However, many inferior products use pyridoxine HCL, which is not the active form of this B vitamin.

Where You Get It

- | | |
|--------------|------------------------|
| ☉ Wheat germ | ☉ Bananas |
| ☉ Liver | ☉ Yellowfin tuna |
| ☉ Peanuts | ☉ Salmon |
| ☉ Legumes | ☉ Poultry |
| ☉ Pork | ☉ Potatoes (with skin) |

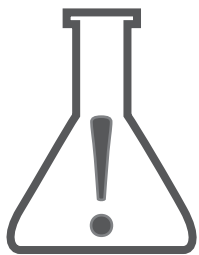
How It Can Lose Its Potency

Large amounts of **vitamin B6** are lost during most forms of cooking and processing. Approximately 38% of **B6** is lost from the canning of fruits, 15% from the freezing of fruits, 70% from the canning of vegetables, and up to 75% from the conversion of fresh meat into meat by-products. In general, the more acidic a food, the more **B6** is lost during cooking.

VITAMIN B₇

:: Biotin

RDI : 30 mcg



Signs of Vitamin B₇ Deficiency

- △ Hair loss
- △ Loss of hair color
- △ Depression
- △ Scaly dermatitis
- △ Lesions on the nose and mouth
- △ Anorexia
- △ Nausea
- △ Numbness and tingling of the extremities
- △ Muscle pain
- △ Cardiac irregularities
- △ Seizures
- △ Poor muscle tone
- △ Anxiety and stress

Why You Need It

Biotin is essential for the activity of many enzyme systems. It aids in the metabolism of fat and sugar and converts sugar into its usable chemical energy. **Biotin** is also required for an enzyme called CoA carboxylase to put together the building blocks for the production of fat in the body. Fat, a part of every cell membrane, aids in separating the inner workings of cells from their environment. This is especially important for cells that must be rapidly replaced, such as skin cells.

How It Fights Osteoporosis

Biotin helps metabolize carbohydrates, fats, and amino acids from dietary intake; aids in the synthesis of bone marrow. **Vitamin B7 (biotin)** deficiency affects IGF-1 status (insulin-like growth factor is fundamental in skeletal growth) and bone formation.

How To Identify Beneficial Forms & Quantities

The **d-** in front of **biotin** means it is the preferred natural form, **dl-** means it is synthetic.

Where You Get It

- ☯ Liver
- ☯ Milk
- ☯ Egg yolk
- ☯ Yeast
- ☯ Pork
- ☯ Salmon
- ☯ Avocado
- ☯ Cheddar cheese
- ☯ Peanuts
- ☯ Swiss chard
- ☯ Cauliflower
- ☯ Almonds

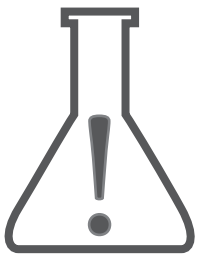
How It Can Lose Its Potency

Avidin, a protein found in egg whites, can bind with **biotin** and prevent its absorption. However, thoroughly cooking the egg whites denatures avidin, allowing the body to absorb biotin. **Biotin** is fairly stable when exposed to heat, light, and oxygen.

VITAMIN B₉ :: Folate

RDI : 400 mcg

Signs of Vitamin B₉ Deficiency



- △ Irritability
- △ Mental fatigue and forgetfulness
- △ Depression
- △ Fatigue
- △ Hair loss
- △ Gingivitis
- △ Cleft palate
- △ Periodontal disease
- △ Vitiligo (loss of skin pigmentation)
- △ Dry skin
- △ Elevated homocysteine

Why You Need It

Folate is often publicized for its importance in pregnancy to prevent neural tube defects (spina bifida). It has been shown that mothers with **folate** deficiency give birth to a greater number of infants with neural tube defects. It also works with vitamins

B6 and B12 to lower homocysteine levels. Deficiency in **folate** can lead to megaloblastic anemia, but it is important to note that megaloblastic anemia caused by a **folate** deficiency is identical to the anemia caused by vitamin B12 deficiency, making a B12 deficiency hard to identify. **B9**, a water-soluble vitamin, also reduces dementia and Alzheimer's, prevents bone fractures, and aids in healthy circulation. One of **folate's** most important duties is cell reproduction. **B9** is necessary for making the nucleic acids DNA and RNA, which act as instruction manuals for your cells.

How It Fights Osteoporosis

Folate plays a role in reducing homocysteine levels (increased homocysteine levels are a risk factor for osteoporotic bone fractures). It equips you to better deal with stress by aiding in the formation of chemicals called neurotransmitters; in folate-deficient osteoclasts, resorption activity was found to be significantly increased. Dietary **folate** is a significant predictor for BMD.

How To Identify Beneficial Forms & Quantities

5-MTHF is the bioactive form of **B9**. Because of the large population with the genetic enzyme defect (known as the MTHFR mutation) that makes it difficult for them to convert both **folate** and **folic acid** into biologically active **5-MTHF**, **5-MTHF** is a more effective method of **folate** supplementation.

Where You Get It

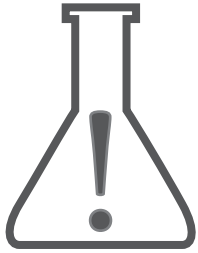
- | | |
|-------------------|----------------|
| ☯ Romaine lettuce | ☯ Broccoli |
| ☯ Spinach | ☯ Whole grains |
| ☯ Asparagus | ☯ Wheat germ |
| ☯ Liver | ☯ Eggs |
| ☯ Garbanzo beans | ☯ Peanuts |
| ☯ Lentils | ☯ Sprouts |

How It Can Lose Its Potency

Plants (like spinach) can lose up to 40% of their **folate** content from cooking, while **folate** in meat is far more stable when cooked. Despite the fact that the processing of grains causes up to 70% of **folic acid** to be depleted, **Vitamin B9** is not one of the micronutrients that is enriched in these products.

VITAMIN B₁₂ :: Cobalamin

RDI : 2.4 mcg



Signs of Vitamin B₁₂ Deficiency

- △ Dandruff
- △ Nervousness/anxiety
- △ Decreased blood clotting
- △ Numbness or tingling in the feet, decreased reflexes
- △ Paleness
- △ Fatigue/weakness
- △ Depression, memory problems
- △ Red or sore tongue, difficulty swallowing
- △ Heart palpitations, weak pulse
- △ Menstrual problems

Why You Need It

Vitamin B12 works with vitamin B6 and vitamin B9 (folate) to regulate elevated homocysteine levels, a risk factor for cardiovascular disease. This water-soluble vitamin is also an essential growth factor and plays a role in the metabolism of cells. **B12** helps maintain the nervous system in that it is required for the synthesis of myelin, the insulation around nerves. Moreover, deficient levels of **B12** are also thought to play a role in Alzheimer's disease and depression. **Vitamin B12** is available naturally in animal products only. Gastric acid in the stomach is needed to properly separate **B12** from our food and create free-form **B12**, which can then be absorbed. (Supplemental **B12** is already in its free form so it does not require gastric acid.) However, proper **B12** absorption is dependent on it binding with a protein made in the stomach called intrinsic factor, which helps **B12** make its way from the gastrointestinal tract—the stomach and intestines—into the rest of the body. Without intrinsic factor, **vitamin B12** cannot gain access to the rest of the body where it is needed. People who do not eat animal foods or consume the suggested amount of **vitamin B12** from dietary supplements are prone to **vitamin B12** deficiency. Additionally, as you age, the risk of inadequate **vitamin B12** absorption rises. A deficiency can cause pernicious anemia, a condition in which red blood cells fail to develop properly. **B12** is also unique among water-soluble vitamins in that a relatively large amount can be stored in the liver.

How It Fights Osteoporosis

Vitamin B12 plays a roll in reducing homocysteine levels (increased homocysteine levels are a risk factor for osteoporotic bone fractures). It is required for osteoblasts to function; proven to have a protective role in preserving BMD and reducing fracture risk.

How To Identify Beneficial Forms & Quantities

The standard source of **B12**, cyanocobalamin, is not a natural source. In fact, it's not found anywhere in nature and must be converted by the liver into **methylcobalamin** in order to be usable by humans (and all other animals). Cyanocobalamin is typically found in inexpensive, inferior products. **Methylcobalamin** is the preferred bioactive form of **vitamin B12**.

Where You Get It

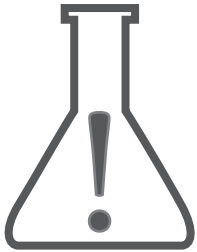
- | | |
|-----------|------------|
| ☯ Clams | ☯ Oysters |
| ☯ Mussels | ☯ Venison |
| ☯ Crab | ☯ Shrimp |
| ☯ Salmon | ☯ Scallops |
| ☯ Snapper | ☯ Beef |
| ☯ Liver | ☯ Cheese |

How It Can Lose Its Potency

B12 in animal foods is well preserved during cooking. Approximately 70% of this vitamin remains after heating animal foods for a period of about 30 minutes.

CHOLINE

RDI : 425 mg



Signs of Choline Deficiency

- △ Difficulty focusing
- △ Memory problems
- △ Lack of energy
- △ Persistent brain fog
- △ Anxiety

Why You Need It

Choline assists vitamin B6 and folate in the methylation process, which helps with building DNA, exchanging signals in the brain, and detoxification processes in the liver. It is also essential in producing phosphatidylcholine, a key structural building block for every cell in the body. Moreover, it provides the backbone to the neurotransmitter acetylcholine, which provides the signal to keep the heart, intestines, and muscles moving, amongst other things.

How It Fights Osteoporosis

Choline is involved in metabolism, transport of lipids, cellular reactions, and the synthesis of neurotransmitters. Subjects with the lowest dietary total **choline** had a higher risk of low BMD.

Where You Get It

- ☯ Shrimp
- ☯ Eggs
- ☯ Scallops
- ☯ Poultry (chicken, turkey)
- ☯ Fish (tuna, cod, salmon)
- ☯ Beef
- ☯ Collard greens

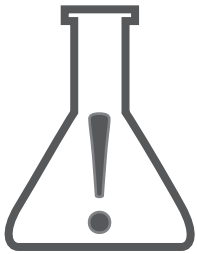
How It Can Lose Its Potency

Choline appears to be unaffected by heat and light.

VITAMIN C

:: Ascorbic Acid

RDI : 90 mg



Signs of Vitamin C Deficiency

- △ Inability to heal wounds
- △ Frequent infections, colds, or flu
- △ Lung-related problems
- △ Easy bruising
- △ Tender, swollen joints
- △ Lack of energy
- △ Bleeding gums
- △ Nosebleeds
- △ Anxiety and stress

Why You Need It

Vitamin C is so critical to living creatures that almost all mammals can make it within their own bodies. However, humans—along with gorillas, chimpanzees, bats, birds, and guinea pigs—are among the few species that cannot make **vitamin C**. Optimal doses of **vitamin C** have been associated with the improvement of many health conditions, including cardiovascular diseases, cancers, joint diseases, cataracts, and the common cold. **Vitamin C** was first discovered as a cure for scurvy. This water-soluble vitamin plays a role in collagen and elastin synthesis, both necessary elements in bone matrix, skin, tooth dentin, blood vessels, and tendons. This powerful antioxidant helps protect against oxygen-based damage to our cells (free radicals). It is required for fat synthesis, and because of its antiviral and detoxifying properties, it can even help heal wounds.

How It Fights Osteoporosis

Vitamin C aids in collagen and elastin synthesis, both necessary elements in bone matrix, tooth dentin, and tendons; enhances calcium absorption; enhances vitamin D's effect on bone metabolism; protects against oxygen-based damage to cells (free radicals, anti-inflammatory); lowers cortisol. Higher **vitamin C** intake levels were associated with a lower risk of osteoporosis in adults over age fifty with low levels of physical activity.

How To Identify Beneficial Forms & Quantities

This fat-soluble form of **vitamin C** is highly absorbable and is more stable than water-soluble forms of **vitamin C**. It doesn't flush out of the body as quickly as ascorbic acid and can be stored in cell membranes until the body needs it. It has also been shown to be protective of other fat-soluble antioxidants. Cell membranes enriched with **ascorbyl palmitate** are more resistant to oxidative damage, which means they are better protected against disease and aging. Science has shown us that more is not always better when it comes to the amount of **vitamin C** one should be taking if they are currently taking a statin drug. The anti-inflammatory effect of cholesterol-lowering statin drugs can be inhibited by taking megadoses of **vitamin C** (more than 200 mg). A multivitamin should not contain more than 200 mg of **vitamin C** to be within the safe range for statin takers.

Where You Get It

- ☯ Sweet red peppers
- ☯ Strawberries
- ☯ Limes
- ☯ Broccoli
- ☯ Liver (beef, calf, pork, chicken)
- ☯ Oysters
- ☯ Kale
- ☯ Oranges (and juice)
- ☯ Grapefruit (and juice)
- ☯ Snow peas
- ☯ Cauliflower
- ☯ Watermelon
- ☯ Cabbage
- ☯ White potatoes

How It Can Lose Its Potency

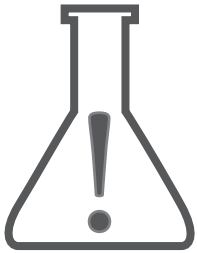
Vitamin C is highly sensitive to light, air, and heat, so you'll get the most **vitamin C** if you eat fruits and vegetables raw or lightly cooked. Approximately 25% of **vitamin C** is lost during blanching (prior to freezing), boiling, or thawing. Cooking for about 20 minutes can cause over half of this vitamin to be destroyed. Reheated canned vegetables contain only a third of the original **vitamin C** content.

VITAMIN D

:: Calciferol

RDI : 800 IU

Signs of Vitamin D Deficiency



- △ Muscle weakness, pain, or twitching
- △ Frequent falls in the elderly or stunted growth in children
- △ Asthma
- △ Lowered immunity
- △ Depression and anxiety
- △ Autoimmune disorders
- △ Pale skin
- △ Obesity
- △ Arthritis
- △ Tooth decay
- △ Thyroid dysfunction/hypothyroidism
- △ Anxiety
- △ Hearing loss due to loss of bone in the middle ear

Why You Need It

Vitamin D is unique in that it is the only vitamin that can be made when skin comes in contact with strong ultraviolet B rays from the sun. Because of this, **vitamin D** is also known as the “sunshine vitamin.” In fact, this fat soluble vitamin is actually a hormone called **calcitriol, 1,25-dihydroxy vitamin D3**, which is triggered by sunlight. This vitamin was first discovered as a cure to help prevent the bone development disease rickets in children. **Vitamin D** helps regulate metabolism, bone and teeth development, muscle function, immune function, insulin activity, calcium balance, and phosphorous balance. It is imperative for maintaining cognitive function, cancer prevention, and healthy heart function and aids in the reduction of inflammation. Due to a major micronutrient synergy, without enough **vitamin D** circulating in your bloodstream, it’s impossible to absorb all the calcium you need.

How It Fights Osteoporosis

Vitamin D mobilizes calcium and phosphorus for release from bone in the presence of parathyroid hormone; promotes intestinal absorption of calcium and phosphate; increases kidney absorption of calcium and phosphorus and carries them into the blood. It also prevents muscle weakness that can promote falls and fractures. People with low levels of **vitamin D** in their blood have lower BMD and an increased incidence of osteoporosis. **Vitamin D** supplements at doses of 700–800 International Units (IU) per day reduced the incidence of hip fracture by 26 percent and other nonvertebral fractures by 23 percent.

How To Identify Beneficial Forms & Quantities

Two forms of **vitamin D** are available in supplements: vitamin D2 (ergocalciferol) and **vitamin D3 (cholecalciferol)**. **D3** is the form that is produced in our skin when we are exposed to sunlight and is biologically superior for supplementation. In fact, research published in the American Journal of Clinical Nutrition found that vitamin D2 supplementation caused a reduction in overall serum concentrations of **vitamin D** over twenty-eight days, with serum levels actually falling below baseline (starting) levels. The researchers concluded that vitamin D2 should no longer be regarded as a nutrient appropriate for supplementation or fortification of foods.

Where You Get It

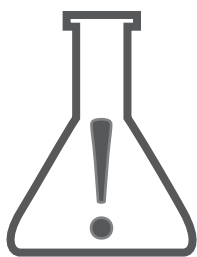
- ☯ Egg yolk
- ☯ Liver (fish, beef)
- ☯ Oysters
- ☯ Fish (salmon, herring, sardines, especially wild caught)
- ☯ Shiitake mushrooms

How It Can Lose Its Potency

Vitamin D is fairly stable: Approximately 25% of the **D** content will be lost when cooked at temperatures above 400°F or 200°C.

VITAMIN E :: Tocopherol + Tocotrienol

RDI : 15 mg (22 IU)



Signs of Vitamin E Deficiency

- △ Dry skin, easy bruising
- △ PMS, hot flashes
- △ Eczema or psoriasis
- △ Poor wound healing
- △ Tingling in extremities
- △ Sterility
- △ Liver and gallbladder problems
- △ Exhaustion after brief exercise
- △ Varicose veins

Why You Need It

Vitamin E has been shown to help repair muscle tissue. Recent research on muscle cells indicates that one of **vitamin E**'s main functions is its antioxidant repair mechanism, which aids in the repair of cell membranes that have been compromised. This new finding may have implications for enhanced athletic performance as well as with genetic muscle-wasting diseases such as muscular dystrophies and amyotrophic lateral sclerosis (ALS, or Lou Gehrig's disease). As a powerful antioxidant, this fat-soluble vitamin prevents cell damage from free radicals. This is important for heart health because it decreases platelet adhesion and prevents LDL cholesterol from being oxidized. It promotes healthy skin by protecting the skin from ultraviolet radiation (UV light). **Vitamin E** can also prevent the oxidation of the fatty portion of the cell membranes in the lens of your eye, which protects against AMD and cataracts.

How It Fights Osteoporosis

Vitamin E is a powerful antioxidant that protects against oxygen-based damage to cells (free radicals, anti-inflammatory). One of the eight forms of **Vitamin E**, called **delta-tocotrienol**, can completely prevent the erosion of the bone surface and also be effective in increasing bone formation and preventing bone resorption. Deficiency in another form of **vitamin E**, **alpha-tocopherol**, was associated with an 86 percent increase in the rate of hip fracture, whereas use of **alpha-tocopherol**-containing supplements was associated with a 22 percent reduction in the rate of hip fracture.

How To Identify Beneficial Forms & Quantities

Vitamin E is split into two families: the tocopherols and the tocotrienols, each containing four unique derivatives (alpha, beta, gamma, and delta). Look on the label for "**full spectrum d-tocopherols and d-tocotrienols**." Additionally, avoid the synthetic form of this vitamin, which starts with dl-. According to a study published in the American Journal of Clinical Nutrition, researchers found that levels of natural **vitamin E (d-tocopherol)** in the blood and in the organs were double that of synthetic **vitamin E (dl-tocopherol)** when compared, showing that natural **vitamin E** is better retained and more biologically active than the synthetic form. Finally, for those taking a statin, it has been recommended to keep daily **vitamin E** intake to 100 IU or less because **vitamins E** and C have both been shown to inhibit the anti-inflammatory effects of statins.

Where You Get It

- ☯ Nuts (almonds, hazelnuts)
- ☯ Peanuts
- ☯ Sunflower seeds
- ☯ Oil (sunflower, safflower, olive)
- ☯ Greens (mustard greens, chard, kale)
- ☯ Chile peppers
- ☯ Wheat germ
- ☯ Avocados
- ☯ Papaya
- ☯ Spinach
- ☯ Sweet potatoes

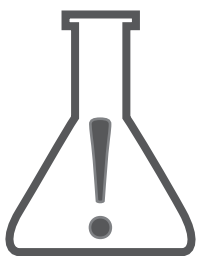
How It Can Lose Its Potency

Vitamin E is greatly depleted by factory processing. In the wheat flour that is used to make 90% of all bread and pasta sold in the U.S., nearly 90% of the **alpha tocopherol** and 43% of the **beta tocopherol** have been removed. This is because the majority of the **vitamin E** in wheat is found in the germ, which is removed during commercial processing. To protect **vitamin E** in oils, make sure they are kept in airtight containers. High-temperature cooking is also quite destructive.

VITAMIN K

:: Quinones

RDI : 120 mcg



Signs of Vitamin K Deficiency

- △ Osteoporosis
- △ Heavy bleeding (gum or menstrual bleeding; nosebleeds)
- △ Hardened arteries
- △ People with serious burns
- △ Liver disease
- △ Celiac disease
- △ Cystic fibrosis
- △ Crohn's disease
- △ Cancer
- △ Type 2 diabetes
- △ Cardiovascular disease

Why You Need It

Vitamin K has an anti-hemorrhagic factor and is essential for proper blood clotting, or coagulation. In fact, the K in **vitamin K** is derived from the German word koagulation, which means “coagulation” in English. Most dietary **vitamin K** comes in the form of **vitamin K1** from plant foods, but the bacteria in our intestines can convert this from **K1** to **K2**. Unfortunately, new research shows that the bacteria may contribute less than previously thought. It also supports bone health in that this fat-soluble vitamin activates the conversion of a bone-building protein called osteocalcin, which shores up bone tissue by binding the minerals that support bone strength.

How It Fights Osteoporosis

Vitamin K2 is an important inducer of bone mineralization in human osteoblasts (bone-building cells); required for the synthesis of osteocalcin. **Vitamin K2** has been proven in studies to be as effective as prescription drugs in reducing the incidence of bone fractures. **Vitamin K2** has also been proven to induce positive changes in bone mass by allowing for proper use of calcium.

How To Identify Beneficial Forms & Quantities

It is important for a supplement to include both **K1** and **K2** and even more superior and rare if it also includes both forms of **vitamin K2 (MK-4 and MK-7)**. **Vitamin K1** plays a role in blood clotting, whereas **K2** is a more important inducer of bone mineralization in human osteoblasts (bone-building cells). The **MK-7 form of K2** is optimal for dietary supplementation because it has a long half-life of two to three days, compared to the one to two hours of **MK-4**. Most products contain unprotected **vitamin K2 MK-7**, which is susceptible to degradation in formulations containing minerals, such as calcium, magnesium, and multivitamin formulations. A specially protected form of **MK-7** called **K2VITAL Delta** protects the **K2** in formulation.

Where You Get It

- ☯ Nattō (Japanese soy dish)
- ☯ Goose liver
- ☯ Gouda cheese
- ☯ Sauerkraut
- ☯ Egg yolk
- ☯ Butter (from 100% grass-fed cows)
- ☯ Ground beef
- ☯ Kale, raw
- ☯ Broccoli
- ☯ Spinach
- ☯ Liver
- ☯ Brussels sprouts
- ☯ Asparagus
- ☯ Green beans
- ☯ Green peas
- ☯ Cauliflower
- ☯ Milk (from 100% grass-fed cows)
- ☯ Tomatoes

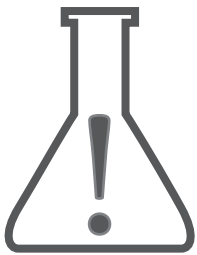
How It Can Lose Its Potency

Foods become higher in **vitamin K1** when they contain less water. For example, tomato paste is higher in **vitamin K** than tomatoes are. Also, the outer leaves of green leafy vegetables are more nutrient rich in **K1** than the inner leaves. When fruits and vegetables are commercially processed into juice, **vitamin K1** is depleted. Alkalies, strong acids, radiation, and oxidizing agents can destroy **vitamin K**. Anticoagulant medications (like warfarin, an anticoagulant widely sold under the brand name Coumadin) interfere with **vitamin K** metabolism. Those taking these prescription drugs still require **vitamin K**; however, in order to decrease the risk of unwanted blood clots, they should inform their physician that they plan on supplementing with **vitamin K** so their physician can adjust the dose appropriately.

MINERALS

BORON

RDI : None.



Signs of Boron Deficiency

△ Arthritis

△ Osteoporosis

Why You Need It

Recent research indicates that **boron** may play a role in metabolism, bone health, immune response, and cognitive function. In humans, bones and dental enamel contain the highest concentrations of **boron**. **Boron** aids in the conversion of vitamin D into its active form, which promotes calcium absorption and deposition in bones. This mineral has been shown to reduce the symptoms of rheumatoid arthritis.

How It Fights Osteoporosis

Boron enhances calcium absorption and estrogen metabolism; stabilizes and extends the half-life of Vitamin D, converting vitamin D to its most active form; reduces the excretion of magnesium; helps metabolize insulin; exhibits an estrogen- enhancing effect and reduces oxidative stress. One study found that **boron** supplements can increase bone formation and inhibit bone resorption.

How To Identify Beneficial Forms & Quantities

Choose a highly absorbable citrate form of **boron**.

Where You Get It

☯ Dried apricots and raisins

☯ Avocados

☯ Nuts (almonds, hazelnuts, Brazil nuts)

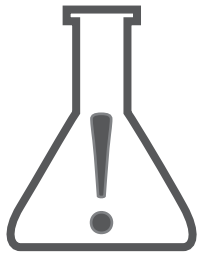
☯ Wine (Shiraz, cabernet)

How It Can Lose Its Potency

Heat, air, and light have no known effect on **boron**.

CALCIUM

RDI : 1300 mg



Signs of Calcium Deficiency

- △ Osteoporosis or rickets
- △ Bone pain or fractures
- △ Muscle pain
- △ Numbness or tingling in extremities
- △ Insomnia
- △ Growth retardation in children
- △ High blood pressure
- △ Tooth decay
- △ Sugar cravings
- △ Anxiety and stress

Why You Need It

Calcium is the most abundant mineral in the human body, making up 1.5% of total body weight. About 99% of **calcium** is found in the bones and teeth, with the remaining 1% found in cells and bodily fluids. A **calcium** deficiency is one of the causative factors of osteoporosis, a disease characterized by brittle and porous bones that affects more than 20 million Americans. Additionally, studies have shown that a sufficiency in **calcium** may reduce the risk of colon cancer and prevent or treat moderate hypertension. It is also required for muscle contraction, blood clotting, and nerve transmission.

How It Fights Osteoporosis

Calcium acts as the primary component required for both strong and dense bone; supports tooth formation. Studies determined that increases in BMD were similar in trials of dietary sources of **calcium** and **calcium** supplements.

How To Identify Beneficial Forms & Quantities

This is the only micronutrient that should be less than 100 percent RDI on your supplement facts. **Calcium** needs an acidic stomach environment to properly be absorbed, which is why we recommend **calcium potassium phosphate citrate**, **calcium citrate**, or **calcium malate**, as they are more absorbable when taken away from food. Since bone mineral is predominately **calcium phosphate**, we recommend the **calcium potassium phosphate citrate** form because it comes with the bone-building micronutrients potassium and phosphate, similar to how it comes in dairy products. Studies have found that **calcium** that contains phosphate helps maintain strong bones and reduce the risk of osteoporosis. Additionally, while the media has reported that **calcium** should not be supplemented because it causes calcification of the arteries, the truth is that it is essential to the human body. This calcification can be completely eliminated by making sure that supplements also contain vitamin K2, so it can direct the **calcium** into the bones, where it belongs.

Where You Get It

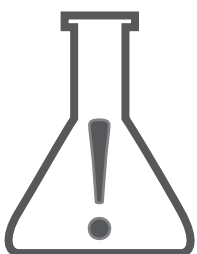
- ☉ Milk/dairy products
- ☉ Sardines
- ☉ Sesame seeds
- ☉ Broccoli
- ☉ Legumes
- ☉ Salmon, canned (bone-in)
- ☉ Bone broth (minimal)
- ☉ Leafy greens

How It Can Lose Its Potency

Cooking and storage do not have an adverse effect on **calcium**.

CHROMIUM

RDI : 35 mcg



Signs of Chromium Deficiency

- △ Impaired glucose tolerance
- △ Cardiovascular disease
- △ High cholesterol
- △ High blood pressure
- △ Cold hands
- △ Cold sweats
- △ Anxiety and depression
- △ Obesity

Why You Need It

Chromium plays an important role in the regulation of blood sugar levels, the enhancement of insulin effectiveness, and the activation of various enzymes for energy production. It also seems to help lower elevated serum cholesterol and triglycerides.

How It Fights Osteoporosis

Chromium preserves bone mineral by reducing the loss of calcium in the urine, promoting collagen production, increasing adrenal DHEA levels, improving insulin regulation, and reducing the rate of bone resorption.

How To Identify Beneficial Forms & Quantities

The most absorbable form of **chromium** is **chromium polynicotinate**. Unlike chromium picolonate, which research suggests may be linked to causing DNA damage, **chromium polynicotinate** is a pure niacin-bound form of **chromium**, identified by U.S. government researchers as the active component of true GTF (glucose tolerance factor), which regulates the body's use of glucose and helps balance blood sugar levels.

Where You Get It

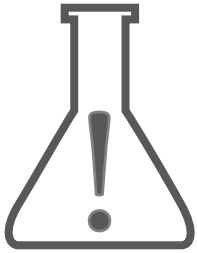
- ☯ Broccoli
- ☯ Onions
- ☯ Tomatoes
- ☯ Whole grains (wheat germ)
- ☯ Romaine lettuce
- ☯ Lean meats
- ☯ Cheese
- ☯ Legumes
- ☯ Nuts

How It Can Lose Its Potency

Chromium is found in the germ and bran of whole wheat and is usually removed when processed. While naturally found in sugar cane, **chromium** is removed during the process of making sugar.

COPPER

RDI : 0.9 mg



Signs of Copper Deficiency

- △ Anemia
- △ Fatigue
- △ Loss of color in the hair and skin (due to decreased synthesis of melanin)
- △ Low body temperature
- △ Nervous system disorders
- △ Blood vessels that rupture easily
- △ Skin sores
- △ Elevated LDL cholesterol
- △ Osteoporosis

Why You Need It

Copper is an essential trace mineral that plays an important role in metabolism and is a critical functional component in a number of essential enzymes known as cuproenzymes. It becomes incorporated into liver enzymes, which are then secreted into the blood as ceruloplasmin, a **copper**-carrying protein and important blood-based antioxidant. Another important role is in oxidation-reduction (redox) reactions, whereby it has the ability to scavenge free radicals. **Copper** is present in every tissue of the body, with the highest concentrations stored in the liver. It is also required for the formation of the connective tissue that helps support the heart, blood vessels, skin, and bones. **Copper** is important for the utilization of iron, so iron deficiency anemia may be a sign of a **copper** deficiency.

How It Fights Osteoporosis

Copper aids in the formation of collagen for bone and connective tissue and contributes to the mechanical strength of bone collagen fibrils (the strands of proteins that cross-link to one another in the spaces around cells); inhibits bone resorption; neutralizes superoxide radicals produced by the osteoclasts (bone-breakdown cells) during resorption. Reduced **copper** levels have been shown to be linked to reduced BMD.

How To Identify Beneficial Forms & Quantities

Taking a multivitamin that contains **copper** is generally not recommended because too much can hinder your body's ability to destroy the proteins that form the plaques found in the brains of Alzheimer's patients. According to Neal D. Barnard, MD, president of the Physicians Committee for Responsible Medicine, many Alzheimer's patients have elevated levels of **copper**, and in studies, it was determined that many of those affected took multivitamins with **copper**. Additionally, pregnant women should avoid **copper** in multivitamins because **copper** levels can nearly double during pregnancy, making toxicity a concern. Cramps, abdominal pain, vomiting, nausea, and diarrhea are all common when taking supplements that include **copper**.

Where You Get It

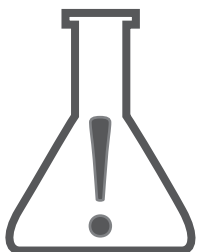
- ☉ Beef liver/organ meats
- ☉ Seafood (oysters, clams, crab, lobster)
- ☉ Nuts
- ☉ Lentils
- ☉ Mushrooms
- ☉ Leafy greens
- ☉ Whole grain breads and cereals
- ☉ Chocolate
- ☉ Seeds (sesame, sunflower)
- ☉ Asparagus

How It Can Lose Its Potency

Long periods of heat can greatly deteriorate **copper** levels in foods. The processing of grain reduces **copper** content by about 70%.

IODINE

RDI : 150 mcg



Signs of Iodine Deficiency

- △ Goiter/hypothyroidism
- △ Depression
- △ Weakness/fatigue
- △ Weight gain

Why You Need It

Iodine's main function is the synthesis of the thyroid hormones thyroxine (T4) and triiodothyronine (T3). It is essential for normal thyroid function. Cells in the thyroid, a small gland located in the front of the neck, just under the voice box, are the only cells capable of absorbing **iodine**. Thyroid cells capture **iodine** and combine it with an amino acid, tyrosine, to produce thyroid hormones that are then released into the bloodstream. A deficiency of dietary **iodine** causes the thyroid to become unable to make thyroid hormones, which control a variety of biological and physiological activities, including body temperature, physical growth, reproduction, neuromuscular function, the synthesis of proteins, and the growth of skin and hair. In some cases of **iodine** deficiency, the thyroid will enlarge (this is known as a goiter). If the thyroid gland is absent or damaged, an individual's basal metabolic rate (BMR) can decline to as low as 55% of its normal rate, resulting in impaired growth and development. Conversely, if the thyroid gland is hyperactive, an individual's BMR can go as high as 160%, causing tachycardia, nervousness, and excitability.

How It Fights Osteoporosis

Iodine deficiency has been shown to result in increased oxidative stress and higher levels of oxidative damage to DNA. Increased oxidative stress has also been highlighted as one of the underlying mechanisms of osteoporosis. **Iodine** is an essential element for bone mineralization, and **iodine** deficiency is frequently observed in postmenopausal patients with osteoporosis.

How To Identify Beneficial Forms & Quantities

Because of our polluted waters, kelp is no longer considered a good safe source of **iodine**. We recommend **potassium iodide**.

Where You Get It

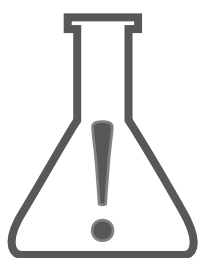
- ☯ Seaweed
- ☯ Iodized salt
- ☯ Cod
- ☯ Seafood
- ☯ Milk
- ☯ Yogurt
- ☯ Eggs
- ☯ Potatoes (with skin)
- ☯ Turkey
- ☯ Navy beans
- ☯ Strawberries

How It Can Lose Its Potency

Iodine does not lose potency in preparation or cooking. Instead, it is added into many processed foods in the form of iodized table salt.

IRON

RDI : 18 mg for women | 8 mg for men



Signs of Iron Deficiency

- △ Weakness/fatigue
- △ Headaches
- △ Pale skin/brittle nails
- △ Depression and stress
- △ Poor immune system
- △ Inability to concentrate
- △ Pale skin
- △ Sore tongue
- △ Hypothyroidism

Why You Need It

Iron is an essential micronutrient that is found in every cell in the human body. The primary functions of **iron** include oxygen transport within blood and muscle and the conversion of blood sugar into energy. About 70% of the **iron** in the body is stored in the blood in the form of hemoglobin. Dietary **iron** is found in two forms: heme **iron** and non-heme **iron**; however, heme **iron** is primarily found in animal sources and has an absorption rate of 30% compared to the 3% absorption rate from non-heme **iron**. Vitamin C can enhance the absorption of **iron**, particularly of non-heme **iron**. A deficiency in **iron** leads to the inability of red blood cells to carry oxygen needed by cells; when this happens, anemia may result. This mineral is needed for optimal immunity and aids in fatty acid metabolism as well as liver detoxification.

How It Fights Osteoporosis

Iron is a co-factor the enzymes involved in collagen synthesis. In laboratory tests, low levels of **iron** may lead to lower bone strength. It is essential for vitamin D metabolism. Chronic **iron** deficiency induces bone resorption and risk of osteoporosis.

How To Identify Beneficial Forms

Iron is an essential mineral your body needs to function normally. However, the National Institutes of Health's Office of Dietary Supplements has indicated that too much **iron** can cause serious health complications. Because of this, we recommend an **iron**-free multivitamin to avoid **iron** overload, a medical condition that causes excess **iron** to be stored in vital organs, such as the liver and heart. Too much **iron** may be toxic— and even fatal. In general, **iron** supplementation is not recommended for adult males and postmenopausal women. If you are a premenopausal woman, an athlete who works out for more than six hours a week, or a strict vegan/ vegetarian, you may want to consider **iron** supplementation. Additionally, **iron** is an extremely competitive nutrient. Because of this, **iron** should always be taken at a different time of day from one's multivitamin.

Where You Get It

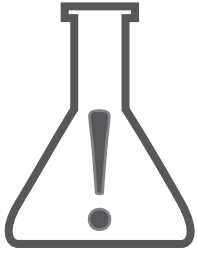
- ☯ Liver
- ☯ Shellfish (oysters, mussels)
- ☯ Beef
- ☯ Fish
- ☯ Poultry
- ☯ Kidney beans
- ☯ Lentils
- ☯ Dried fruits (prunes/raisins)
- ☯ Potatoes (with skin)
- ☯ Cashews
- ☯ Blackstrap molasses
- ☯ Tofu

How It Can Lose Its Potency

Refining and processing grain removes about 75% of the **iron**. While some is added back in through fortification, this type is less absorbable. While many people believe that spinach is a good form of **iron**, the oxalic acid in raw spinach depletes availability by as much as 97%.

MAGNESIUM

RDI : 420 mg



Signs of Magnesium Deficiency

- △ Weakness
- △ Muscle cramps
- △ Loss of appetite
- △ GI disorders
- △ Fear and irritability
- △ High blood pressure
- △ Depression
- △ Insomnia
- △ Increased heart rate
- △ Imbalanced blood sugar levels
- △ Constipation

Why You Need It

Magnesium is involved in over 300 essential metabolic reactions in the body and is necessary for the transmission of muscular activity, nerve impulses, temperature regulation, blood pressure regulation, detoxification reactions, and the formation of healthy bones and teeth. It is also involved in the synthesis of DNA and RNA and in energy production. Deficiency in **magnesium** can compromise cellular activity, especially in the tissues of the heart, kidneys, and nerves. In our bodies, the majority of **magnesium** is found in our bones (~60–65%) and muscles (25%), but as with all minerals, it cannot be made in our bodies and thus needs to be plentiful in our diets in order for us to remain healthy. Moreover, a **magnesium** deficiency can cause a sugar craving.

How It Fights Osteoporosis

A constituent of the bone matrix, **magnesium** is required for osteoblast production, development, and activity; assists in calcium absorption; fights destructive inflammation; ensures the strength and firmness of bones; stimulates the thyroid's production of calcitonin; regulates parathyroid hormone; required for forming new calcium crystals for proper bone formation. Lower **magnesium** intake is associated with lower BMD of the hip and whole body.

How To Identify Beneficial Forms & Quantities

Most multivitamins supply inadequate amounts of **magnesium** because of its bulky size. While the malate, glycinate, taurate, L-threonate and orotate are all good, we prefer **magnesium citrate** because it is the most highly studied for its high bioavailability.

Where You Get It

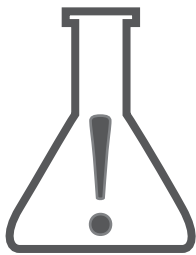
- ☯ 100% bran cereal (oat bran)
- ☯ Brown rice
- ☯ Nuts/seeds
- ☯ Legumes
- ☯ Dark leafy vegetables
- ☯ Broccoli
- ☯ Potatoes (with skin)
- ☯ Bananas
- ☯ Milk/cheese
- ☯ Fish/shellfish

How It Can Lose Its Potency

Blanching, steaming, and boiling can cause a major depletion of **magnesium**. For example, spinach loses a third of its **magnesium** when blanched, and beans can lose up to 65%. Processing of grain causes major **magnesium** depletion; approximately 85% is lost during the production of white flour.

MANGANESE

RDI : 2.3 mg



Signs of Manganese Deficiency

Deficiency is rare because magnesium is capable of substituting for many of manganese's enzyme-related functions.

- △ Skeleton abnormalities
- △ Weak ligaments
- △ Hearing loss
- △ Skin rash
- △ Vomiting and nausea
- △ Low cholesterol
- △ Inferior reproductive system

Why You Need It

Manganese is a cofactor that aids in the activation of a wide variety of enzymes. These enzymes influence many biological activities, including the synthesis of collagen and the maintenance of connective tissue and cartilage; metabolism of amino acids, fats, carbohydrates, and cholesterol; regulation of blood clotting; bone development; and antioxidant function. A deficiency in **manganese** has been shown to result in poor growth and impaired reproduction in animals and may be related in some way to osteoporosis, diabetes mellitus, and seizure disorders in humans.

How It Fights Osteoporosis

Manganese is a cofactor in the formation of bone cartilage and bone collagen, as well as in bone mineralization. Helps with the formation of bone-regulatory hormones and enzymes involved in bone metabolism. **Manganese** is the preferred cofactor of enzymes called glycosyltransferases; these enzymes are required for the synthesis of proteoglycans that are needed for the formation of healthy cartilage and bone. Deficiencies in **manganese** have been correlated with lower bone density and bone strength.

How To Identify Beneficial Forms & Quantities

Manganese gluconate is a highly bioavailable form of **manganese**.

Where You Get It

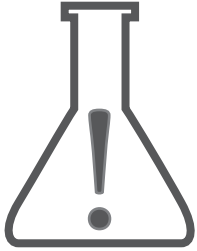
- ☯ Nuts/seeds
- ☯ Dried beans
- ☯ Cereal grains
- ☯ Pineapple
- ☯ Green tea
- ☯ Green leafy vegetables
- ☯ Cinnamon
- ☯ Berries

How It Can Lose Its Potency

Manganese is significantly lost due to the processing of whole grains to produce white flour. Approximately 60% of the **manganese** in beans is lost when cooked, proving **manganese** to be susceptible to heat.

MOLYBDENUM

RDI : 45 mcg



Signs of Molybdenum Deficiency

Deficiency is rare because so little is needed by the body.

⚠ A rare genetic deficiency condition known as molybdenum-cofactor deficiency syndrome causes unexplained seizures.

⚠ Individuals with a genetic defect that prevents the formation of sulfite oxidase are at high risk of molybdenum deficiency.

Why You Need It

Molybdenum is one of the rarest substances on earth, yet small amounts of this mineral are found in all tissues of the human body. This mineral assists a small number of enzymes, the most important of which is sulfite oxidase, which is involved in the metabolism of sulfur-containing amino acids.

How It Fights Osteoporosis

Molybdenum is a component of superoxide dismutase, which is a powerfully anti-inflammatory enzyme that targets superoxide, the most prevalent free radical in the body that can significantly prevent oxidative damage and act to restore and rejuvenate your bones.

How To Identify Beneficial Forms & Quantities

Molybdenum glycinate is the best absorbed, most highly bioavailable form of molybdenum.

Where You Get It

☯ Wheat germ

☯ Organ meats

☯ Green leafy vegetables

☯ Legumes

☯ Nuts

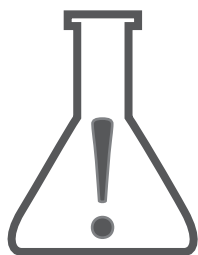
☯ Whole grains

How It Can Lose Its Potency

Food processing that removes the germ from grains destroys nearly 50% of **molybdenum**.

PHOSPHORUS

RDI : 1250 mg



Signs of Phosphorus Deficiency

Deficiency is rare.

△ Confusion

△ Bone pain

△ Decreased immune system

Why You Need It

Phosphorus is the second most abundant mineral in the human body, behind calcium, but participates in more biological processes than any other mineral. It is required for the normal function and metabolism of every cell in the body, with 85% found in the skeleton and 15% in the rest of the cells of the body. This essential mineral is part of cell membranes and participates in the inner workings of cells as part of the nucleic acids DNA and RNA, which store and transmit genetic information. It is a major structural component of cell membranes, which help regulate what moves in and out of cells. It also lends strength to bones and teeth, and it is integral to the structure of soft tissue. It is essential for muscle contraction, nerve cell communication, regular heartbeat, and the balance between acidity and alkalinity in the blood.

How It Fights Osteoporosis

Phosphorous combines with calcium to form a mineral crystal that gives strength and structure to our bones and teeth. Up to 70 percent of absorbed and retained phosphorus combines with calcium to help form bone and tooth structure; the remaining 30 percent combines with nitrogen to metabolize fats and carbohydrates. High intake of **phosphorus** has no adverse effect on bone metabolism in populations with adequate calcium intake, and it is also associated with positive bone parameters in some age/gender groups.

Where You Get It

☯ Yogurt

☯ Animal protein

☯ Soft drinks

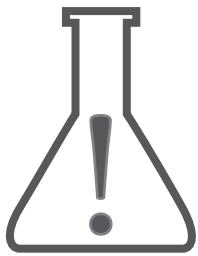
☯ Nuts/seeds/lentils (**phosphorus** in these foods is about 50% less bioavailable)

How It Can Lose Its Potency

The effects of preparation are unknown.

POTASSIUM

RDI : 4700 mg



Signs of Potassium Deficiency

△ Fatigue

△ High blood pressure

△ Muscle weakness

△ Irritability

△ Cellulite

Why You Need It

Along with sodium and chloride, **potassium** is one of the body's three major electrolytes, which means they have the ability to conduct electricity when dissolved in water and are the main particles responsible for osmotic pressure and bodily fluids. **Potassium** is the primary electrolyte functioning inside our cells, while sodium and chloride predominantly function outside the cells. **Potassium** is important in regulating the frequency and degree to which our muscles contract and the degree to which our nerves become excitable. This essential mineral helps regulate pH levels in bodily fluids, blood pressure, and muscle and nerve activity, including the beating of the heart.

How It Fights Osteoporosis

Potassium neutralizes bone-depleting metabolic acids; **potassium** conserves calcium within the body and reduces urinary calcium loss. Studies show that **potassium** can decrease bone breakdown and stimulate new bone formation in postmenopausal women.

How To Identify Beneficial Forms & Quantities

Potassium is readily absorbed through the intestinal tract, and excess is efficiently excreted in the urine via the kidneys. Supplements that contain **calcium potassium phosphate citrate** naturally deliver **potassium**.

Where You Get It

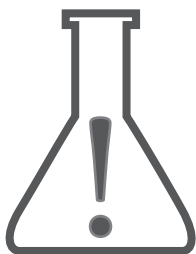
- ☯ Potatoes (with skin)
- ☯ Prunes
- ☯ Raisins
- ☯ Bananas
- ☯ Acorn squash
- ☯ Lima beans
- ☯ Leafy greens
- ☯ Cremini mushrooms
- ☯ Coconut water
- ☯ Meats
- ☯ Pumpkin
- ☯ Cauliflower
- ☯ Dairy products

How It Can Lose Its Potency

Losses from cooking are extensive (50%). It easily leaches into water.

SELENIUM

RDI : 55 mcg



Signs of Selenium Deficiency

- △ White nail beds
- △ Discoloration of skin and hair
- △ Muscle weakness
- △ Signs of premature aging
- △ Cataracts
- △ High blood pressure
- △ Infertility
- △ Hypothyroidism
- △ Anxiety and depression

Why You Need It

Humans and animals require **selenium** for the synthesis of **selenium** dependent enzymes called selenoproteins. **Selenium** plays important roles in detoxification and antioxidant

defense mechanisms in the body and seems to have a strong protective synergy with vitamins C and E. A deficiency in **selenium** may put you at risk for impaired immune function, viral infection, certain types of cancer, and cardiovascular disease. Adequacy of **selenium** can help protect against the free radicals that are generated by everyday living and in response to cigarette smoke, pollution, heavy metals, and other environmental factors, including today's modern toxins found in foods as well as in home and beauty products. Like iodine, **selenium** is essential for proper functioning of the thyroid gland. It helps regulate how much T3 (a version of the thyroid hormone) is produced.

How It Fights Osteoporosis

Selenium is a powerful antioxidant that protects against oxygen-based damage to cells (free radicals, anti-inflammatory). Studies have shown that **selenium** deficiency changes bone metabolism and reduces BMD and bone volume.

How To Identify Beneficial Forms & Quantities

Selenomethionine is a superior bioavailable organic form of **selenium**.

Where You Get It

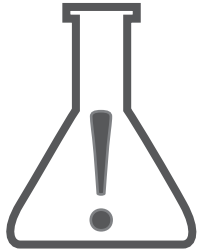
- ☯ Brazil nuts
- ☯ Seafood (tuna, halibut, lobster, salmon)
- ☯ Liver
- ☯ Dairy
- ☯ Eggs
- ☯ Muscle meats
- ☯ Whole grains
- ☯ Garlic
- ☯ Cabbage
- ☯ Celery

How It Can Lose Its Potency

Selenium in beans and vegetables is easily destroyed by boiling (50%). In addition, 75% of the **selenium** is depleted when wheat is turned into white flour. The processing of rice is equally devastating (brown rice has 15 times more **selenium** than white rice). **Selenium** in meat sources is quite stable when cooked.

SILICON (SILICA)

RDI : None



Signs of Silicon Deficiency

Silicon is so abundant in the environment that outright deficiencies do not occur.

Why You Need It

The largest concentrations of **silicon** are found in the skin, hair, and cartilage, but it also exists in connective tissue, tendons, bone, the trachea, the aorta, and the lungs. A **silicon** deficiency may be associated with the development of osteoarthritis, osteoporosis, and some aspects of cardiovascular disease. **Silicon** is often referred to as the beauty mineral because it is often used to enhance the look of hair, nails, and skin. Moreover, some epidemiological and experimental studies suggest that **silica** can reduce oral absorption of aluminum and/or enhance aluminum excretion and protect against aluminum-induced adverse effects, which may help in the prevention of Alzheimer's disease.

How It Fights Osteoporosis

Silicon strengthens the connective tissue matrix by cross-linking collagen strands. Increases the rate of mineralization, particularly when calcium intake is low; plays an important role in initiating the calcification process, thus helping us to maintain strong, flexible bones. Stimulates osteoblasts (bone-building cells) by increasing protein collagen synthesis; inhibits osteoclasts (bone-resorbing cells) by directly discouraging bone resorption. In one study, researchers noted that at least 40 mg of daily **silicon** accounted for 10 percent higher BMD than lower intakes around 14 mg of **silicon** per day. Another study found that individuals who supplemented with **silicon** enjoyed significant increases in trabecular bone volume.

How To Identify Beneficial Forms & Quantities

Horsetail is a natural herbal extract that is rich in **silica**.

Where You Get It

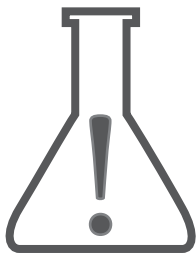
- ☯ Beer
- ☯ Coffee
- ☯ Mineral water
- ☯ Fish
- ☯ Nuts/seeds
- ☯ Oats
- ☯ Bran
- ☯ Brown rice
- ☯ Whole grains
- ☯ High-fiber vegetables
- ☯ Fruits (including mangoes, melons, dates, apples)

How It Can Lose Its Potency

The effects of preparation on **silicon** are unknown.

ZINC

RDI : 11 mg



Signs of Zinc Deficiency

- △ Growth failure (dwarfism, hypogonadism, failure to mature sexually)
- △ Depression and anxiety
- △ Impaired sense of taste and/or smell
- △ Poor immune system
- △ Poor appetite
- △ Night blindness
- △ Stretch marks
- △ Acne
- △ Hypothyroidism

Why You Need It

Zinc is an essential micronutrient that is required for the functioning of over 300 different enzymes and plays a vital role in an enormous number of biological processes. Additionally, **zinc** is necessary for the regulation of genetic activity and protein and cell membrane structure. In humans, the highest concentrations of **zinc** are found in the liver, pancreas, bones, kidneys, and muscles, but it is also highly concentrated in parts of the eye, prostate gland, sperm, skin, hair, and nails. This essential mineral helps regulate a wide variety of immune system activities. **Zinc** supports smell and taste because gustin, a small protein

that is directly related to taste, must be attached to **zinc** for taste to work. Taste and smell are so entwined that this then affects smell. **Zinc** is also necessary for night vision, wound healing, thyroid function, metabolic rate, sexual function, and blood sugar balance.

How It Fights Osteoporosis

Zinc plays a role in the activity of osteoblasts and osteoclasts; required in the production of the matrix of collagen protein threads on which the bone-forming calcium-phosphorus compound is deposited. Proper calcium absorption also depends on **zinc**, and a deficiency prevents full absorption of calcium. A **zinc** deficiency will delay bone growth, bone development, and maintenance of bone health. Low serum **zinc** is associated with low BMD in women.

How To Identify Beneficial Forms & Quantities

Zinc glycinate is a well-absorbed, highly bioavailable form of **zinc**.

Where You Get It

- ☯ Shellfish (oysters, mussels, crab)
- ☯ Liver
- ☯ Dairy products
- ☯ Beef
- ☯ Chicken (dark meat)
- ☯ Eggs
- ☯ Pork
- ☯ Whole grains
- ☯ Lamb
- ☯ Nuts
- ☯ Green peas

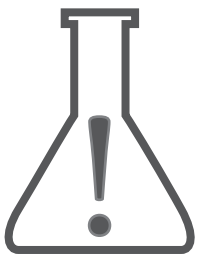
How It Can Lose Its Potency

Food processing removes 75% of **zinc** content from grains. Like most minerals, **zinc** incurs great losses in the presence of water, so boiling and blanching should be avoided.

FATTY ACIDS

OMEGA-3 FATTY ACIDS

RDI : 1.6 g



Signs of Omega-3 Deficiency

- △ Dry, scaly rash
- △ Decreased growth in infants and children
- △ Decreased immune system
- △ Poor wound healing
- △ Health conditions marked by inflammation
- △ Impaired sense of taste or smell

Why You Need It

Omega-3 fatty acids (ALA, EPA, DHA) are one of two classes of micronutrients called essential fatty acids (EFAs). As their name implies, EFAs are essential to mammals because we cannot synthesize them. A major source of their benefits can be found in their anti-inflammatory properties. **Omega-3** is a structural component of cell membranes. **DHA** may play an especially important role in vision and nervous system function in that it is selectively incorporated into postsynaptic neuronal cell membranes as well as retinal cell membranes. Studies indicate that **DHA** is required for the normal development and function of the retina, where **DHA** is found in high concentrations. **DHA** is found in high proportions in the phospholipids of the gray matter of the brain. A deficiency of **DHA** may be related to learning defects. Research shows that both **omega-3** and omega-6 fatty acids may actually have the ability to modulate the expression of our genes, including genes involved in inflammation and fatty acid metabolism. **Omega-3s** are also heart protective, as they serve as the raw materials for making compounds that are critical to proper blood clotting, helping arteries relax and contract properly.

Although popular plant-derived **omega-3s** (like flaxseed and chia) do have anti-inflammatory effects and will help you achieve a lower ratio of omega-6 to **omega-3** in your diet, they do not contain **EPA** or **DHA**. Instead, they contain only **alpha-linoleic acid (ALA)**, which the body has to convert into **EPA** and then into **DHA**. The problem with plant-based **omega-3** supplements is that studies on **ALA** metabolism in healthy young

men indicate that only 5 to 10 percent of dietary **ALA** is converted to **EPA** and 2 to 5 percent is then converted to **DHA**. Women can convert **ALA** to **EPA** and then to **DHA** approximately 2.5 times better than men can. This means that even at the highest conversion rates, a 1,000-mg plant-derived **omega-3** capsule would produce only approximately 100 mg (10 percent) of **EPA** and 50 mg (5 percent) of **DHA** in men, and 210 mg (21 percent) of **EPA** and 90 mg (9 percent) of **DHA** in women. These quantities are no-where near what is considered beneficial by the medical and nutritional communities.

How It Fights Osteoporosis

Omega-3 reduces inflammation, which is essential for those with bone loss because research shows that inflammation activates osteoclasts, the cells that break down bone. **EPA** and **DHA** help to build healthy bones by signaling to special cells that live in our bone marrow called mesenchymal stem cells (MSCs) to become osteoblasts rather than fat cells. Increase osteoblast production can also to produce an important anti-inflammatory compound called osteoprotegerin (OPG).

What You Should Know

One problem with fish oil is that research has discovered that the beneficial components **EPA** and **DHA** compete with one another for absorption, just like certain vitamins and minerals. Because of this, we created Origin Omega, which is the first and only **omega-3** product formulated using our patented Anti-Competition Technology to separate the **EPA** and **DHA** to eliminate the competition and greatly improve the absorption and utilization potential of both.

Where You Get It

- ☯ Herring, sardines (wild caught)
- ☯ Salmon (chinook, Atlantic, and sockeye, all wild caught)
- ☯ Shellfish (oysters, Dungeness crab)
- ☯ Rainbow trout
- ☯ White tuna (canned, light)
- ☯ Flaxseeds (and oil)
- ☯ Chia seeds
- ☯ English walnuts (and oil)
- ☯ Canola oil
- ☯ Soybean oil
- ☯ Tofu (firm)
- ☯ Grass-fed beef
- ☯ Pastured eggs
- ☯ Mammal brains/eyes (lamb, pork, etc.)

How It Can Lose Its Potency

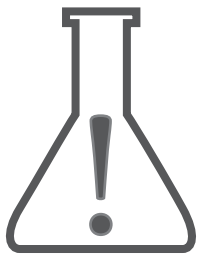
All polyunsaturated oils, including **omega-3** and omega-6 fatty acids, are extremely

susceptible to oxidation, becoming rancid from heat, light, and oxygen. Whole food sources, such as flaxseeds (as opposed to flaxseed oil), are better protected. **Omega-3** oils should be stored in a dark or opaque glass container in the refrigerator or freezer and should never be heated on the stove for sautéing, as this will damage the oil. Instead, use these oils cold in yogurt or on salad.

OMEGA-6 FATTY ACIDS

RDI: 17 g

Note: This daily dose has been seriously questioned; due to a methodology error, these needs may have been overestimated by 5 to 15 times the actual requirements.



Signs of Omega-6 Deficiency

- △ Dry, scaly rash
- △ Decreased immune system
- △ Decreased growth in infants and children
- △ Poor wound healing

Why You Need It

Omega-6 fatty acids (LA, GLA, DGLA, AA, DA) are the other type of essential fatty acid (EFA). Although **omega-6 fatty acids** are typically associated with inflammation while omega-3 fatty acids are considered anti-inflammatory, **GLA** and **DGLA** are both thought to have anti-inflammatory properties. While **omega-6 fatty acids** are essential, the American diet is so full of plant-based oils that contain high amounts of **omega-6** (particularly **LA**) that the ratio of **omega-6s** to omega-3s can be as high as 30:1. It is thought that an equal or slightly greater ratio of omega-3 to **omega-6 fatty acids** is best for the promotion of health. Think yin and yang.

How It Fights Osteoporosis

Omega-6 creates an elongated fatty acid called **AA**, which is pro-inflammatory. Remember, inflammation activates osteoclasts, the cells that break down bone. Too much **AA** means chronic inflammation, which results in a loss of BMD and, finally, in osteoporosis. **AA** also signals to your MSCs to become fat cells, which greatly reduces the number of bone-building osteoblasts. And as if that weren't enough, **AA** also inhibits the osteoblasts you do have from producing that amazing, anti-inflammatory compound OPG. Although we strive to keep **omega-6** levels low and in balance with omega-3s, **gamma-linolenic acid (GLA)** is an **omega-6 fatty acid** that has anti-inflammatory properties similar to those of omega-3s (unlike other **omega-6s**, which are considered inflammatory). Studies show that

supplementing with **GLA** (200– 300 mg) can help support healthy progesterone levels and increase bone density.

What You Should Know

Omega-6s can be found in both plant and animal sources; however, plant sources contain mostly the **omega-6s** known as **alpha linoleic acid (LA)** and **GLA**. While it is true that humans can convert **LA** into **GLA** and then **DGLA** in the body, this elongation process only takes place at an efficiency rate of approximately 5 to 10% for **LA** to **GLA**. The **GLA** to **DGLA** rates are less clear but likely have a similar rate. As such, it may be beneficial to obtain your **omega-6s** from sources naturally high in **GLA**, such as evening primrose, borage, or black currant oil.

Where You Get It

- ☯ Safflower oil
- ☯ Grapeseed oil
- ☯ Sunflower seeds (and oil)
- ☯ Soybean oil
- ☯ Olive oil
- ☯ Nuts (Brazil nuts, pecans, cashews, pine nuts)
- ☯ Sesame oil
- ☯ Evening primrose oil
- ☯ Borage oil
- ☯ Seed oils (black currant, flaxseed/linseed, rapeseed, hemp)
- ☯ Whole grain breads and durum wheat
- ☯ Cereals
- ☯ Avocados

How It Can Lose Its Potency

All polyunsaturated oils, including **omega-6** and omega-3 fatty acids, are extremely susceptible to oxidation, becoming rancid from heat, light, and oxygen. Whole food sources, such as olives (as opposed to olive oil), are better protected. **Omega-6** oils should be stored in the dark or in opaque glass containers and should not be heated on the stove for sautés or sauces to temperatures over 350°F, as this may damage the oil (with the exception of grapeseed oil, which has a smoke point of 428°F): Remember, you bought your extra-virgin olive oil or flaxseed oil “cold-pressed” for a reason. For the most nutritional benefit, you may want to use these oils cold on cooked meat or fish or on salads. If you are looking for an alternative to cooking with olive oil, you may want to try our SKINNYFat Olive, which reduces the **omega-6** content by 85% and still tastes like the Mediterranean oil you love. Additional options include grass-fed butter, ghee, and organic coconut oil. You can prolong the life of **omega-6** oils by keeping them refrigerated.

AMINO ACIDS

HISTIDINE

RDI : 14 mg/kg body weight

Why You Need It

Histidine is essential in the production of histamine, which has roles in immune response and as a neurotransmitter. It is also used to create carnosine, which has antioxidant properties. Moreover, it helps maintain the myelin sheath on nerve cells. It is a natural detoxifier for the body. Low levels have been linked to rheumatoid arthritis and deafness from nerve damage.

How It Fights Osteoporosis

Protein (and the amino acids it delivers) helps to maintain muscle and prevent of falls and fractures. It has also been shown to have a multitude of incredible, scientifically proven health benefits such as lowered stress (which is a causative factor for osteoporosis) and boosted beneficial gut bacteria (which can help in the absorption and creation of essential nutrients).

What You Should Know

Histidine requires vitamins B3, B6, and C to be properly metabolized.

Where You Get It

- ☯ Meats (pork, poultry, beef)
- ☯ Dairy products
- ☯ Egg whites
- ☯ Whey
- ☯ Eggs
- ☯ Wheat germ

How It Can Lose Its Potency

Histidine is destroyed by exposure to light and oxygen in storage.

ISOLEUCINE

RDI : 19 mg/kg body weight

Why You Need It

Isoleucine, as well as the other two branched-chain amino acids (BCAAs), leucine and valine, plays a critical role in supplying energy to the muscles, particularly during strenuous exercise. It is also effective at preventing muscular wasting associated with aging, amyotrophic lateral sclerosis (ALS), anorexia, and various cancers as well as in bedridden patients. This amino acid is best known for its ability to increase endurance, help heal and repair muscle tissue, and encourage clotting at the site of injury.

How It Fights Osteoporosis

Protein (and the amino acids it delivers) helps to maintain muscle and prevent of falls and fractures. It has also been shown to have a multitude of incredible, scientifically proven health benefits such as lowered stress (which is a causative factor for osteoporosis) and boosted beneficial gut bacteria (which can help in the absorption and creation of essential nutrients).

What You Should Know

Vitamin B7 (biotin) is essential for the total breakdown of **isoleucine** and leucine and thus must be sufficient to adequately utilize **isoleucine**.

Where You Get It

- | | |
|-----------|--------------|
| ☯ Eggs | ☯ Cheese |
| ☯ Turkey | ☯ Whey |
| ☯ Chicken | ☯ Peas |
| ☯ Lamb | ☯ Wheat germ |
| ☯ Fish | |

How It Can Lose Its Potency

BCAAs, such as **isoleucine**, are relatively stable to light, heat, and air.

LEUCINE

RDI : 42 mg/kg body weight

Why You Need It

Leucine is essential to the liver, muscle, and adipose tissue and is the only dietary amino acid with the ability to stimulate muscle protein synthesis. It plays a critical role in supplying energy to the muscles, along with the other two branched-chain amino acids (BCAAs), isoleucine and valine. The prevention of muscular wasting, associated with aging, amyotrophic lateral sclerosis (ALS), anorexia, various cancers, and strenuous exercise as well as in bedridden patients, is among the primary roles of **leucine**.

How It Fights Osteoporosis

Protein (and the amino acids it delivers) helps to maintain muscle and prevent of falls and fractures. It has also been shown to have a multitude of incredible, scientifically proven health benefits such as lowered stress (which is a causative factor for osteoporosis) and boosted beneficial gut bacteria (which can help in the absorption and creation of essential nutrients).

A study published in the *Journal of Bone and Mineral Research* proved that higher intakes of six of the bone-protective amino acids (alanine, arginine, glutamic acid, **leucine**, lysine, and proline) were significantly associated with higher BMD at the spine and forearm. Additionally, **leucine** has a direct effect on the initiation of mRNA translation (the second imperative biological process of gene expression) and is thought to be the most efficient of the branched-chain amino acids at increasing muscle protein synthesis, which is critical for the maintenance of adequate bone strength and density. Finally, **leucine** (along with arginine, lysine, alanine, proline, and glutamine) has been shown to promote osteoblast growth and differentiation.

What You Should Know

Vitamin B7 (biotin) is essential for the total breakdown of **leucine** and isoleucine and thus must be sufficient to adequately utilize **leucine**. Moreover, **leucine** deficiency can be the result of inadequate vitamin B6.

Where You Get It

- ☯ Whey
- ☯ Beef
- ☯ Peanuts
- ☯ Pork
- ☯ Salmon
- ☯ Wheat germ
- ☯ Almonds
- ☯ Chicken
- ☯ Egg yolk
- ☯ Oats

How It Can Lose Its Potency

BCAAs, such as **leucine**, are relatively stable to light, heat, and air.

LYSINE

RDI : 38 mg/kg body weight

Why You Need It

Lysine is a necessary building block for all protein in the body, and without it, no other proteins are assimilated. In conjunction with glycine and proline, **lysine** helps with producing collagen, which is essential for maintaining hair, skin, nail, and connective tissue health. Other important roles include recovery from injury and the production of hormones, enzymes, and antibodies. Moreover, **lysine** is able to interact with serotonin receptors to reduce anxiety and anxiety-induced gastrointestinal distress. Some studies have shown that **lysine** may be beneficial for those with herpes simplex infections.

How It Fights Osteoporosis

Protein (and the amino acids it delivers) helps to maintain muscle and prevent of falls and fractures. It has also been shown to have a multitude of incredible, scientifically proven health benefits such as lowered stress (which is a causative factor for osteoporosis) and boosted beneficial gut bacteria (which can help in the absorption and creation of essential nutrients).

Lysine has been scientifically studied to increase calcium absorption. A study published in the *Journal of Bone and Mineral Research* proved that higher intakes of six of the bone-protective amino acids (alanine, arginine, glutamic acid, leucine, **lysine**, and proline)

were significantly associated with higher BMD at the spine and forearm. **Lysine** (along with arginine and glycine) have been associated with an improvement in collagen formation or synthesis, which can play a huge role in your battle against osteoporosis. Finally, arginine, **lysine**, alanine, proline, leucine, and glutamine have been shown to promote osteoblast growth and differentiation.

What You Should Know

Lysine improves calcium absorption, thus improving its bioavailability and reducing the total amount of calcium needed to be taken.

Where You Get It

- | | |
|-----------|------------|
| ☉ Eggs | ☉ Almonds |
| ☉ Beef | ☉ Cod |
| ☉ Pork | ☉ Sardines |
| ☉ Poultry | ☉ Lentils |
| ☉ Whey | ☉ Seaweed |
| ☉ Cheese | |

How It Can Lose Its Potency

Lysine can be slightly reduced by high heat.

METHIONINE

RDI : 19 mg/kg body weight

Why You Need It

Methionine has antioxidant properties, can help prevent heavy metal toxicity by chelating these metals, and acts as a precursor to amino acids, proteins, and hormones, such as cysteine, taurine, carnitine, choline, adrenaline, and melatonin. It also plays a role in the prevention of neurodegenerative and cardiovascular diseases. **Methionine** has a fat-dissolving effect and reduces the depositing of fat in the liver. It has anti-inflammatory properties, acts as a pain reliever, and stimulates the formation of cartilage tissue.

How It Fights Osteoporosis

Protein (and the amino acids it delivers) helps to maintain muscle and prevent of falls and fractures. It has also been shown to have a multitude of incredible, scientifically proven health benefits such as lowered stress (which is a causative factor for osteoporosis) and boosted beneficial gut bacteria (which can help in the absorption and creation of essential nutrients).

Additionally, the amino acid **methionine** contains anti-inflammatory properties and is among the cartilage-forming substances and **methionine** restriction has been studied to cause reduced bone mass.

What You Should Know

Interestingly, some animal studies have shown that **methionine** restriction may increase lifespan; while this research has not been carried out in humans, **methionine** is an essential amino acid, and it is important to maintain sufficient levels of it.

Where You Get It

- | | |
|-----------------------|-------------------|
| ☯ Eggs and egg whites | ☯ Chicken |
| ☯ Sesame seeds | ☯ Tuna and salmon |
| ☯ Cheese | ☯ Beef |
| ☯ Brazil nuts | ☯ Pork |
| ☯ Whey | ☯ Wheat germ |

How It Can Lose Its Potency

Dehydration may reduce levels of **methionine** in food.

PHENYLALANINE

RDI : 33 mg/kg body weight

Why You Need It

Phenylalanine acts as a precursor to the amino acid tyrosine, which then eventually leads to the production of the catecholamines dopamine, norepinephrine (noradrenaline), and

epinephrine (adrenaline). Deficiency may lead to depression, confusion, and lack of appetite, as well as impairment of memory and energy.

How It Fights Osteoporosis

Protein (and the amino acids it delivers) helps to maintain muscle and prevent of falls and fractures. It has also been shown to have a multitude of incredible, scientifically proven health benefits such as lowered stress (which is a causative factor for osteoporosis) and boosted beneficial gut bacteria (which can help in the absorption and creation of essential nutrients).

What You Should Know

Phenylalanine uses the same pathways across the blood-brain barrier as tryptophan; thus, excessive levels can potentially lead to deficiencies in serotonin, niacin, and melatonin. Additionally, the relatively rare genetic disorder phenylketonuria (PKU) is the result of an impaired ability to break down **phenylalanine**. This leads to excess levels in the brain, which can result in developmental delays, seizures, and attention deficit disorders.

Where You Get It

- | | |
|------------------------------|-------------|
| ☯ Beef | ☯ Whey |
| ☯ Poultry | ☯ Nuts |
| ☯ Pork | ☯ Legumes |
| ☯ Fish | ☯ Seeds |
| ☯ Dairy (milk/yogurt/cheese) | ☯ Aspartame |

How It Can Lose Its Potency

Phenylalanine is relatively stable to light, oxygen, and heat.

THREONINE

RDI : 20 mg/kg body weight

Why You Need It

Threonine is converted to glycine in the body, where it has a role in mitigating the effects of spasticity in disorders such as multiple sclerosis (MS) and amyotrophic lateral sclerosis (ALS) as well as in the production of collagen, elastin, and enamel. It also assists in fat metabolism in the liver and maintaining proper function of the gastrointestinal tract. **Threonine** helps keep connective tissues and muscles in the body elastic and strong, including in the heart, where it is found in significant amounts. It also aids in bone and tooth enamel building and may help speed wound healing and recovery from injury.

How It Fights Osteoporosis

Protein (and the amino acids it delivers) helps to maintain muscle and prevent of falls and fractures. It has also been shown to have a multitude of incredible, scientifically proven health benefits such as lowered stress (which is a causative factor for osteoporosis) and boosted beneficial gut bacteria (which can help in the absorption and creation of essential nutrients). Additionally, **threonine** is a necessary component in tooth enamel, collagen, and elastin.

What You Should Know

Adequate vitamin B12 is required for some of **threonine's** metabolic pathways.

Where You Get It

- | | |
|-----------|------------------|
| ☯ Turkey | ☯ Cottage cheese |
| ☯ Chicken | ☯ Fish |
| ☯ Eggs | ☯ Lentils |
| ☯ Whey | ☯ Black beans |
| ☯ Beef | ☯ Sesame seeds |

How It Can Lose Its Potency

Threonine is relatively stable to preparation.

TRYPTOPHAN

RDI : 5 mg/kg body weight

Why You Need It

Tryptophan is a precursor to the production of niacin and the neurotransmitter serotonin, which in turn produces the hormone melatonin. It plays a role in decreasing anxiety and appetite, promoting normal sleep patterns, and improving irritable bowel syndrome (IBS). It can be useful in reducing premenstrual syndrome (PMS) symptoms. Deficiencies can lead to mood swings and depression.

How It Fights Osteoporosis

Protein (and the amino acids it delivers) helps to maintain muscle and prevent of falls and fractures. It has also been shown to have a multitude of incredible, scientifically proven health benefits such as lowered stress (which is a causative factor for osteoporosis) and boosted beneficial gut bacteria (which can help in the absorption and creation of essential nutrients).

Additionally, **tryptophan** is a precursor to melatonin. Melatonin increases differentiation of human MSC (mesenchymal stem cells) into the osteoblastic cell lineage. Results of melatonin action on bone are anabolic and antiresorptive.

What You Should Know

Tryptophan, with the assistance of vitamins B1, B2, and B6, is a provitamin to vitamin B3 (niacin) and thus can help ensure niacin sufficiency.

Where You Get It

- | | |
|----------------|-----------|
| ☉ Whey | ☉ Salmon |
| ☉ Cocoa powder | ☉ Oats |
| ☉ Cashews | ☉ Walnuts |
| ☉ Peas | ☉ Eggs |
| ☉ Pork | ☉ Turkey |

How It Can Lose Its Potency

Tryptophan is not water-soluble and relatively resistant to cooking.

VALINE

RDI : 24 mg/kg body weight

Why You Need It

Valine, as well as the other two branched-chain amino acids (BCAAs) isoleucine and leucine, plays a critical role in supplying energy to the muscles, particularly during strenuous exercise. It is also effective at preventing muscular wasting associated with aging, amyotrophic lateral sclerosis (ALS), anorexia, and various cancers as well as in bedridden patients.

How It Fights Osteoporosis

Protein (and the amino acids it delivers) helps to maintain muscle and prevent of falls and fractures. It has also been shown to have a multitude of incredible, scientifically proven health benefits such as lowered stress (which is a causative factor for osteoporosis) and boosted beneficial gut bacteria (which can help in the absorption and creation of essential nutrients).

What You Should Know

Valine helps bind proteins together.

Where You Get It

☯ Eggs

☯ Turkey

☯ Chicken

☯ Lamb

☯ Fish

☯ Cheese

☯ Whey

☯ Seaweed

How It Can Lose Its Potency

BCAAs, such as **valine**, are relatively stable to light, heat, and air.